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PRODUCTION ROUND-TABLE: PAGE 106

MAY, 1944

The TOOL ENGINEER

Official Publication of
American Society of Tool Engineers

"What it Takes" For
ABRASION
RESISTANCE

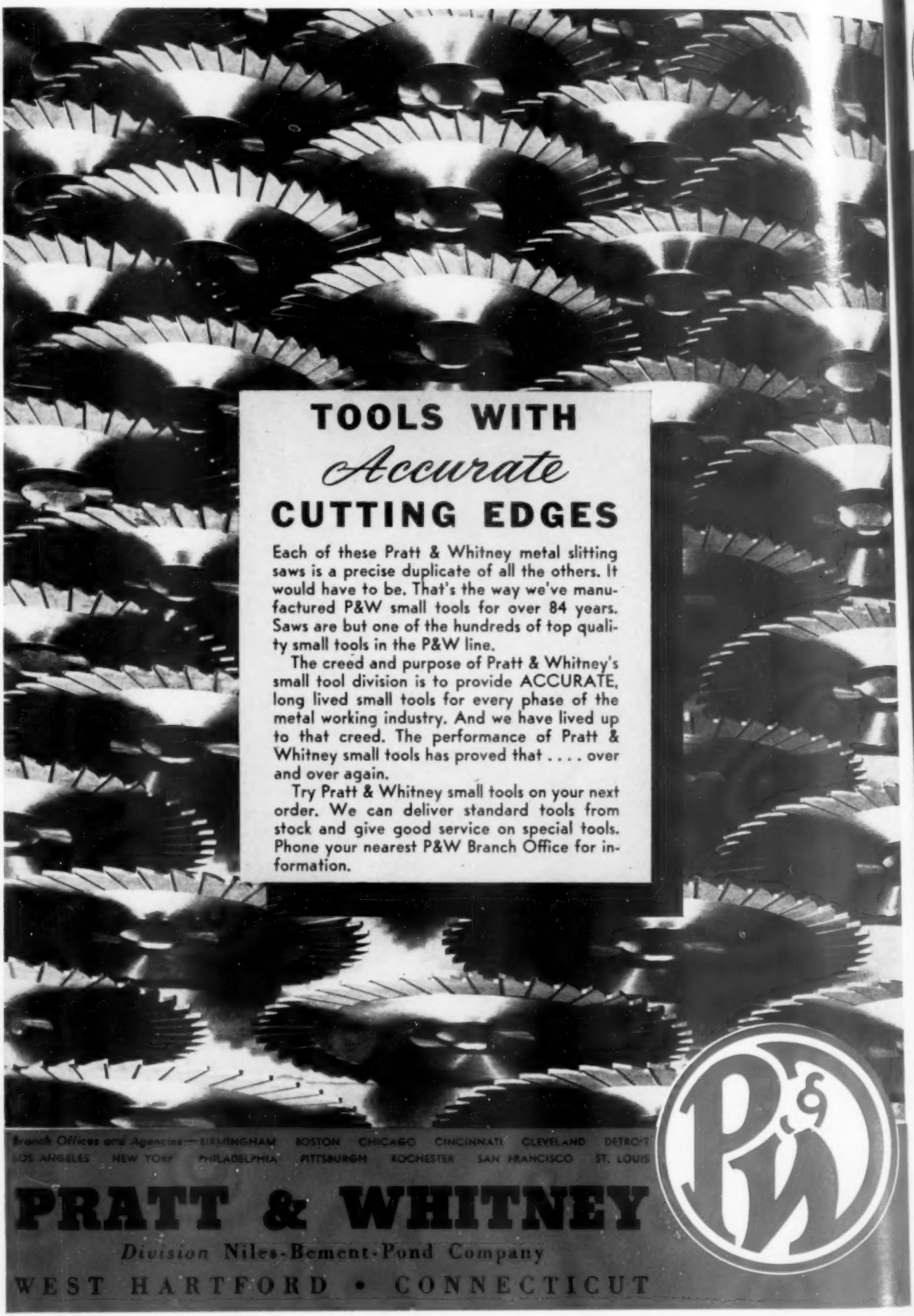
THREE TIMES LONGER LIFE
BETWEEN GRINDS—ON THIS
SLOW-SPEED SCRAPING JOB!

VICTORY
COBALT

These VICTORY COBALT tipped broad-tread and flange-forming tools make abrasion resistance mean what it says . . . run at 12 feet per minute, smooth-finishing the tread and flange of locomotive tires . . . producing three times as many tires per grind as standard high speed steels on the same application.

Vanadium-Alloys
STEEL CO. LATROBE, PA.

PUBLISHED BY THE BRAMSON PUBLISHING COMPANY



TOOLS WITH *Accurate* CUTTING EDGES

Each of these Pratt & Whitney metal slitting saws is a precise duplicate of all the others. It would have to be. That's the way we've manufactured P&W small tools for over 84 years. Saws are but one of the hundreds of top quality small tools in the P&W line.

The creed and purpose of Pratt & Whitney's small tool division is to provide ACCURATE, long lived small tools for every phase of the metal working industry. And we have lived up to that creed. The performance of Pratt & Whitney small tools has proved that . . . . over and over again.

Try Pratt & Whitney small tools on your next order. We can deliver standard tools from stock and give good service on special tools. Phone your nearest P&W Branch Office for information.

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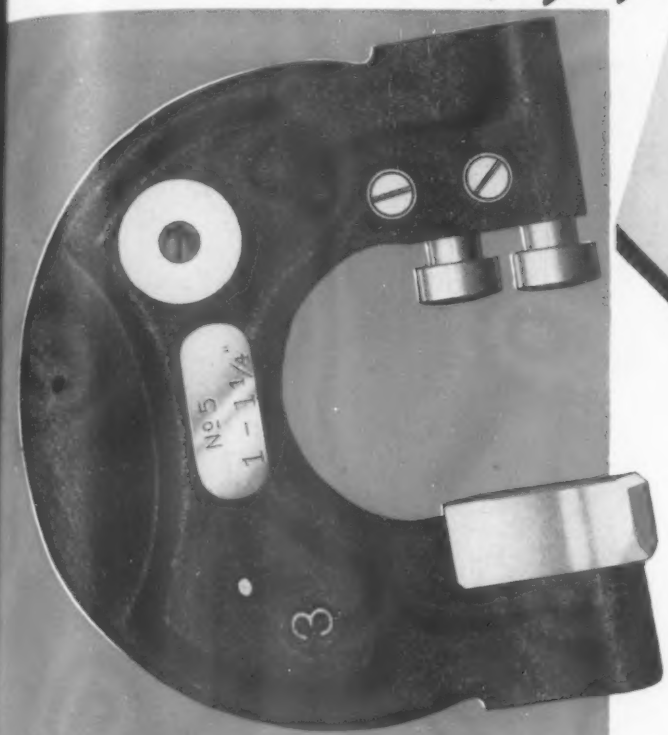
PRATT & WHITNEY

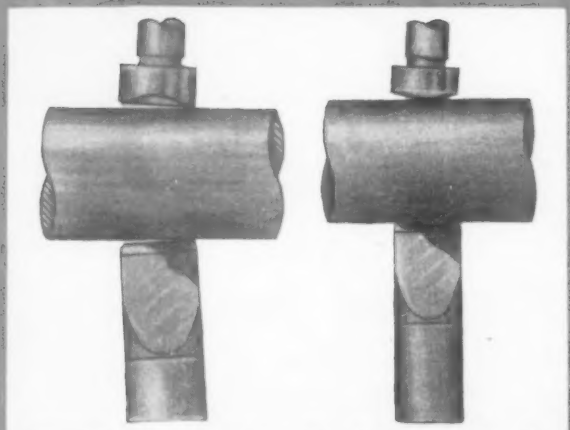
Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

STANDARD SUPER *Snap Gage*

with SPHERICAL Gaging Pins that involve no condition of parallelism, yet provide GREATER ACCURACY in PRECISION INSPECTION





Conventional Snap Gage with flat surfaced gaging pins. The tilt is exaggerated to make the diagram clear. Note that only at their edges do the gaging surfaces contact the piece being gaged.

This illustration shows the Super Snap Gage with the pin shank at the same angle as in the diagram at the left. Note that the contact conditions are exactly the same as if the pin were not tilted.

This illustration shows a Super Snap Gage mounted in a bench stand for convenience in checking.

IMMEDIATE DELIVERY from stock

A *new contact principle...* SIMPLE *and* PRACTICAL

SNAP GAGES are commonly used to control finer tolerances, but strain on the locking device distorts the frame thereby rendering the gage inaccurate. This distortion tilts the flat surfaced pins a few .0001" throwing them out-of-parallel to the common anvil, an important factor when tolerances are measured in .0001".

The STANDARD Super Snap Gage with its SPHERICAL gaging pins eliminates out-of-parallelism. This new spherical-contact principle involves no condition of sustained parallelism. The SUPER Snap Gage is easily set, requiring no simultaneous adjustment to a given dimension and to parallelism. It simplifies inspection, assures greater accuracy, and speeds production and inspection.

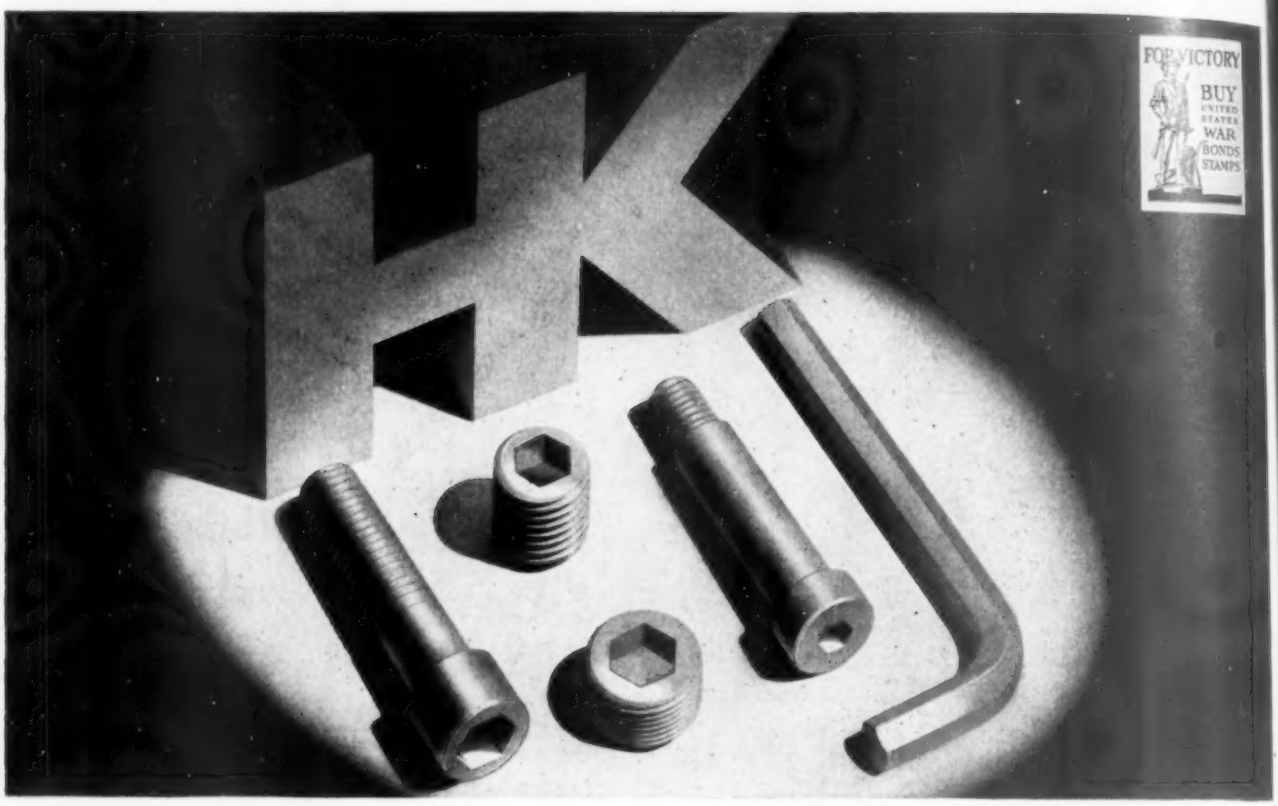
The return of out-of-parallel snap gages for correction is eliminated. Only pins and anvils need be held in reserve, instead of complete gages. The initial cost of the SUPER Snap Gage is no more. Pins are available as separate parts, to fit existing American Gage Design models.

Send for Illustrated Folder

STANDARD GAGE CO., Inc., *Poughkeepsie, N.Y*

HOLO-KROME

TRADE FIBRO FORGED MARK SOCKET SCREWS



THE *BETTER* FASTENING METHOD

SOCKET SCREWS-*Precision made*

Completely Cold Forged ★

★ METHOD PATENTED, OWNED, CONTROLLED AND USED EXCLUSIVELY BY HOLO-KROME IN THE MANUFACTURE OF HOLO-KROME FIBRO FORGED SOCKET SCREWS.

GUARANTEED UNFAILING PERFORMANCE

THE HOLO-KROME SCREW CORP. — SOCKET SCREW PRODUCTS — HARTFORD 10, CONN. U. S. A.

VOLUME XIII MAY, 1944 NUMBER 5

THE TOOL ENGINEER

T.M. REG. BY AMERICAN SOCIETY TOOL ENGINEERS

THE BRAMSON PUBLISHING COMPANY
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Publisher's Letter

INSTEAD of writing this letter to you every month, I only wish it were possible for me to see and visit with each of you who receives this publication. Sitting across the table from you and talking over your problems would be so much more satisfactory than this monthly "One-Way" letter.

Last night I did have the opportunity to do this with several top-flight production engineers of the Toledo industrial area, and we wound up the evening with a regular round-table discussion of what this country's industry is going to need in machinery and tools after the war. I wish each of you could have heard all that was said about the changes in design and capacity that must be made—and **why.** It is impossible for us to print everything that took place in the three hour discussion but a review of the important points covered in our discussion appears in this issue on page 106—"Production Round-Table."

From the many thousands of inquiries we have been receiving from you readers for information about new equipment and tools—via our postage-paid Business Reply Cards, (page 163) which are returned to us—I am sure that production engineers everywhere are "on their toes". You are alert to capitalize on every economy that can be effected and every minute of time that can be saved through more efficient tooling, machining and processing. From the start, when we first copyrighted this feature, it has proved to be one of the most successful things we have done to help you.

●

Some of our Canadian readers have asked us why we have not included these Business Reply Cards in copies sent to Canada. We are just as sorry as they that international postal regulations preclude our using Business Reply Cards for Canadian circulation. However, if our Canadian friends and readers will continue to send us their requests for information, we will be glad to relay the inquiries to the proper authorities and equipment producers.

●

Tonight I am packing my bag for an extended trip to the Pacific Coast—expect to be gone about five weeks. We are confident that we can obtain much valuable information that we can pass on to you in our editorial columns. A sound evaluation of the opportunities for continued industrial expansion west of the Rockies is of first importance to any well considered postwar project. I hope to meet more of you personally and am looking forward with much pleasure to this western trip.

Next month I'll write you from Los Angeles.

Cordially yours,

Roy T. Bramson

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EVEN as you—and all of the rest of us—have contributed men to the Armed Services, so has your Industrial Supply Distributor.

Most of these ISD men had sound training before they ever put on the Uniform. They were trained to locate supplies of scarce or critical materials for your plant—trained in getting them to you on schedule—trained in anticipating your requirements.

Now in the various technical branches of the Services, these men are learning a great deal. They will bring back new experiences, new skills and new ideas from which you are sure to benefit. Today, new men are in the making—for you.

Meanwhile, please continue to call upon your Distributor for all of the things you need instead of ordering direct from the factory. The older and more experienced men are still there—you will simplify the manufacturer's job—and will help to ease the carriers' loads as well.

Get this good habit and *keep* it—

Telephone your I S D FIRST!

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ARMY NAVY

ARMY E NAVY

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

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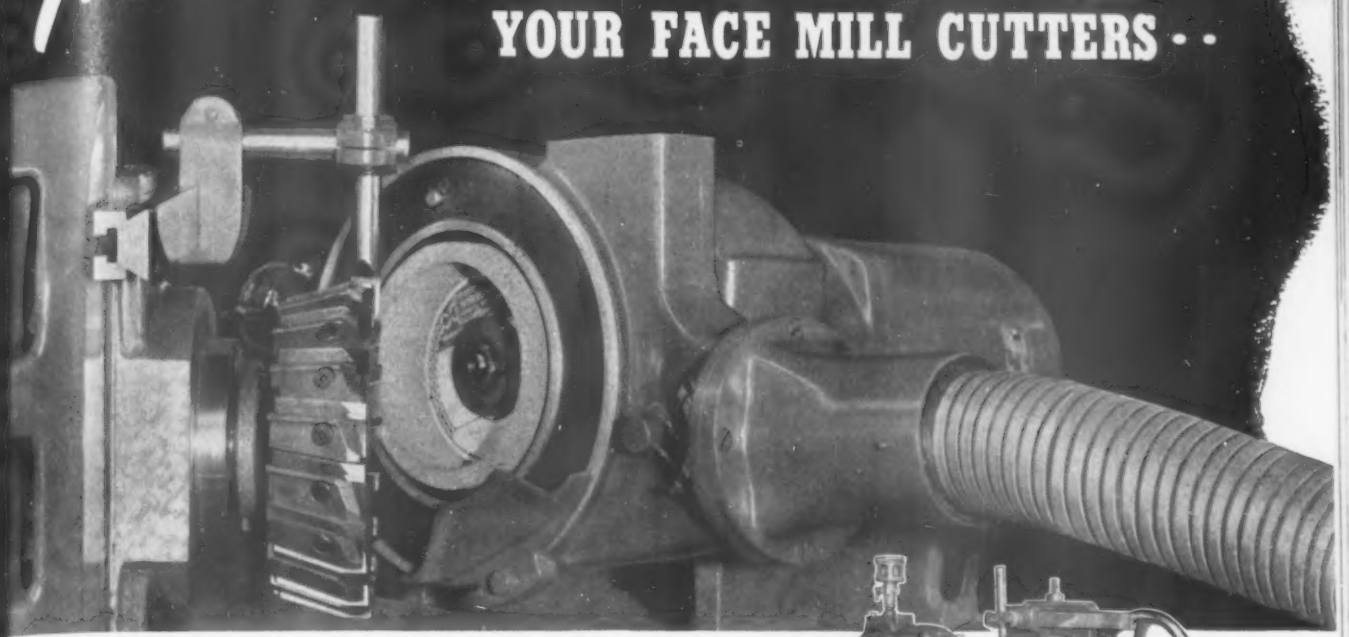
"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

Increase PRODUCTIVE TIME BETWEEN GRINDS ON YOUR FACE MILL CUTTERS··



...Assure a Greater Return From Your Milling Machine Investment

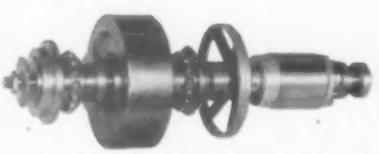
Avoid waste of valuable productive time by constant changing of face mill cutters. The Milwaukee Face Mill Grinder sharpens each tooth accurately — makes cutters last longer — require less frequent regrinding — decreases "down-time" on your milling machines.

An indispensable machine of strength, precision and capacity, the Milwaukee Grinder grinds Tungsten Carbide and other cutters, ranging from 3 inch to 16 inch diameters, to within .0002 runout — and does it fast.

MILWAUKEE FACE MILL GRINDER FEATURES:

- Unusual Rigidity
- Accuracy to within .0002 runout
- Finger-tip controls — handily located for simplified operation
- Design and performance of the Milwaukee substantially reduces sharpening time

- The three-bearing dynamically balanced grinding wheel spindle rotates at 3400 r.p.m.; heavy flywheel keeps abrasive wheel up to full grinding speed—maintains accurate uniform cutting action — each tooth perfectly ground.



- Set-ups quickly made with graduated dial, facilitating quick adjustments

For complete information write for Bulletin 41-A

Rotary Head Milling Machine
•
Autometric Jig Borers
•
Center Scope

Kearney & Trecker *Products*
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
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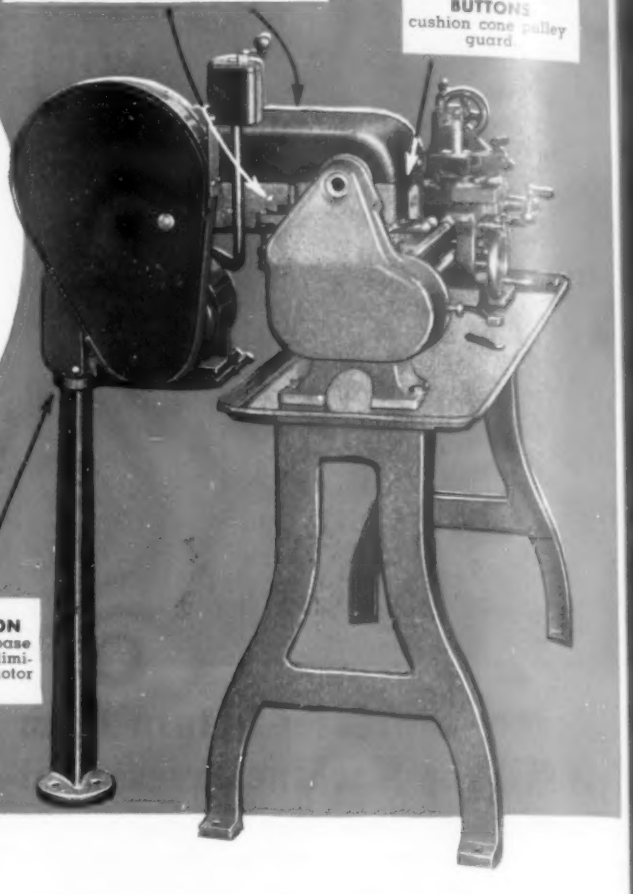
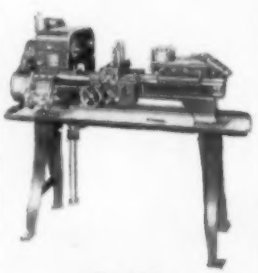
RUBBER CUSHIONED COUNTERSHAFT* and 3-POINT SUSPENSION


TWO RUBBER CUSHIONED BEARINGS, one at each of the two hinge points connecting countershaft and headstock, absorb motor vibration.
TWO RUBBER BUTTONS cushion cone pulley guard.
ONE RUBBER CUSHION between motor mounting base and pedestal further eliminates transmission of motor vibration.

BRIEF SPECIFICATIONS

Swing over bed, 10½"... bed length, 43⅛"...spindle hole, 25/32"...capacity, ⅝" with push type collet...6-position automatic indexing turret . . . stroke of turret, 4¼"...12 spindle speeds from 30 to 1450 r.p.m.... moving parts protected by ball bearings or self-lubricating bronze bearings.



No. 840
Quick Change Gear Turret Lathe with automatic apron

motor vibration absorbed

In Logan Lathes the smooth operation essential to finely finished precision work is doubly assured... first, by rubber cushioning at vital points... second, by carrying the countershaft on a three-point suspension. To absorb the motor's vibration, to prevent its transfer to the lathe proper, the patented Logan countershaft is rubber cushioned at all three of its main supporting points... the pedestal red and the two hinge pins. In addition, the cone pulley guard, which covers both countershaft and headstock, rests on rubber buttons. *The entire Logan countershaft assembly is so designed that at no point is there a direct metal-to-metal contact between countershaft and headstock.* Furthermore, the three-point suspension steadies the whole countershaft assembly so that it cannot rock. This combination of rubber cushioning and three-point suspension is another example of the advanced design that assures sustained accuracy, safe operation, long life, and high-speed, low-cost production in all models of Logan Lathes. Write today for your copy of the latest Logan Catalog.

LOGAN ENGINEERING CO.
CHICAGO 30, ILLINOIS

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

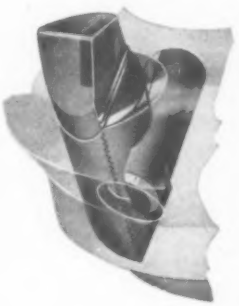
*One of a series describing the finer features of Logan Lathes . . . Look for the next of the series

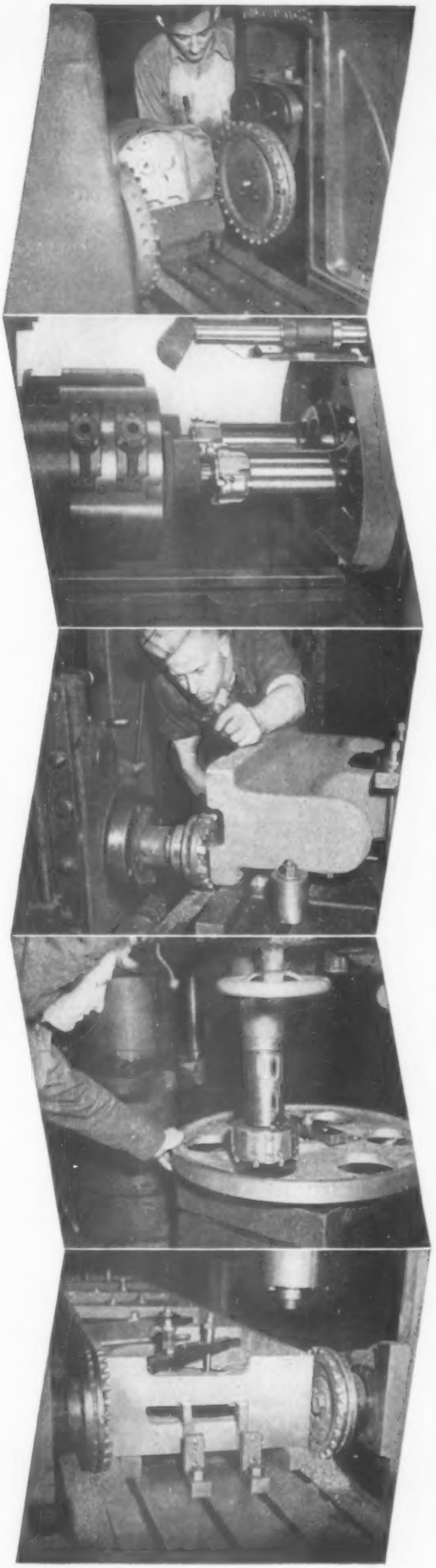
CARBIDE TIPPED

LOVEJOY MILLING CUTTER BLADES

for

HEAVIER CUTS
COARSER FEEDS
HIGHER SPEEDS





The trend is to carbides! But this modern cutting alloy presents certain problems. Will the machine stand the higher speeds and heavier feeds? And how about the cutter? Modern machine tools are built to take this extra strain—and so are modern Lovejoy Milling Cutters. Nowhere else can you find the rigidity in interchangeable milling cutters found in Lovejoy Cutters. Solid forged steel housings, plus *positive-locking* blades make a rugged combination that puts Lovejoy Cutters in a class with solid cutters. That's what makes Lovejoy Cutters ideal for carbide tipped blades—that's why they stand up and produce under heavier cuts, coarser feeds and higher speeds—that's why it will pay you to write for Catalog No. 26 which shows the complete Lovejoy line.

LOVEJOY
TOOL COMPANY, Inc.
SPRINGFIELD, VERMONT, U.S.A.

Severance new tool craftsmen regrind worn tools with the same precise skill they use in making new tools. They give each flute the pitch and depth required to eliminate chatter. They carefully grind each tooth so your renewed tools take deep sharp bites like a new Severance Cutter. Each tool is given the Severite heat treat process that increases tooth hardness and lengthens cutting life 3 to 5 times. It will pay you to send your worn and dull cutters (hand ground, mill or chisel cut) to Severance for a factory regrind job.

Severance

Midget Milling Cutters • Precision Regrinding

SEVERANCE TOOL INDUSTRIES INC., SAGINAW, MICHIGAN • PLANTS IN LONG ISLAND CITY 1, NEW YORK; DETROIT 2, MICHIGAN; FORT WAYNE, INDIANA; CHICAGO 6, ILLINOIS; AND LOS ANGELES 21, CALIFORNIA. IN CANADA: 60 FRONT STREET WEST, TORONTO, ONTARIO

We took HYDRAULICS *one step further in this new Gisholt Turret Lathe*

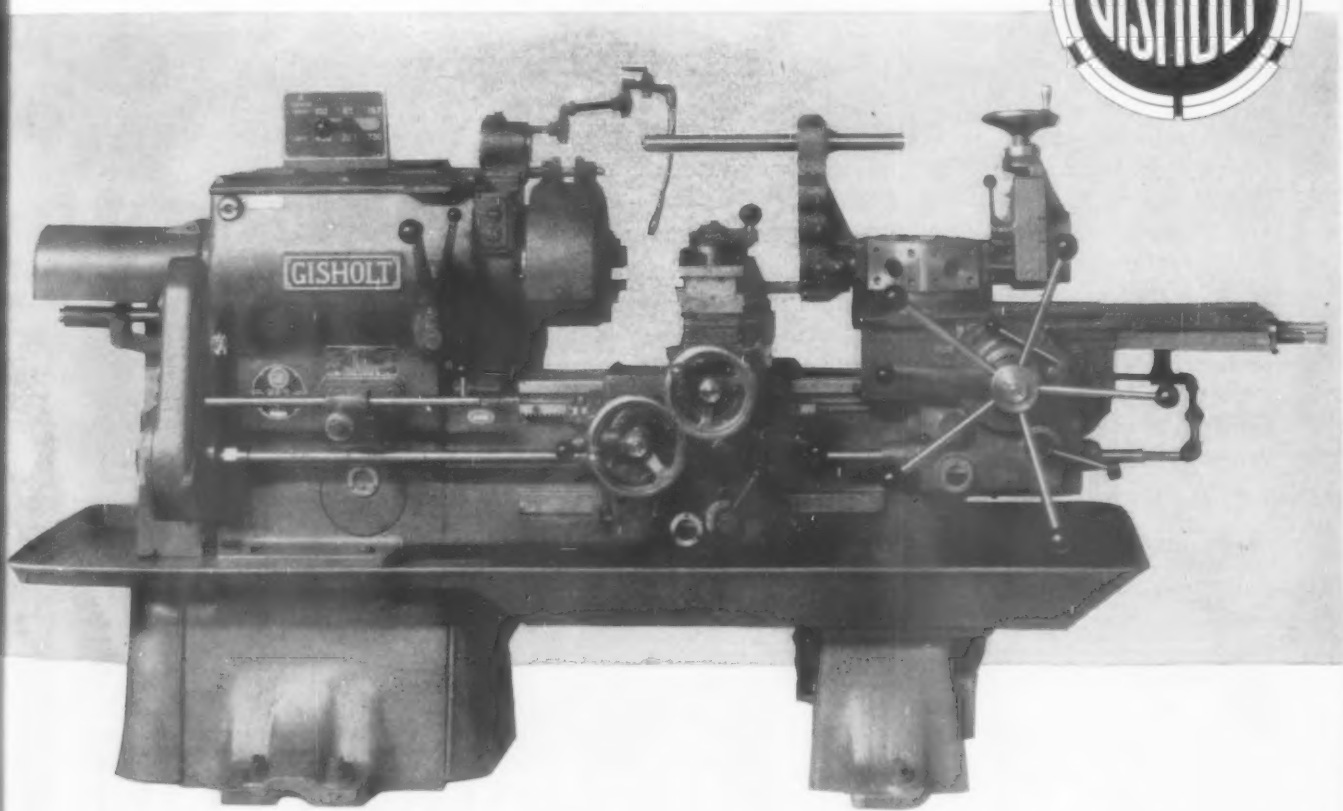
BY utilizing the hydraulic system already provided for pressure lubrication, also for actuating the forward and reverse clutches and brake, operator effort is reduced to a new minimum. A touch of the finger tips is all it takes to engage the clutch for forward or reverse direction. In neutral position, it provides automatic hydraulic spindle braking to bring the work quickly and smoothly to rest. It's *easy* to keep this machine working at top speed.

This newest Gisholt development will save you time and effort for greater war production now—and will cut costs afterward.

GISHOLT MACHINE COMPANY
1229 East Washington Ave. • Madison 3, Wisconsin

LOOK AHEAD . . . KEEP AHEAD . . .
WITH GISHOLT IMPROVEMENTS IN METAL TURNING

GISHOLT



TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

Severance new tool craftsmen regrind worn tools with the same precise skill they use in making new tools. They give each flute the pitch and depth required to eliminate chatter. They carefully grind each tooth so your renewed tools take deep sharp bites like a new Severance Cutter. Each tool is given the Severite heat treat process that increases tooth hardness and lengthens cutting life 3 to 5 times. It will pay you to send your worn and dull cutters (hand ground, mill or chisel cut) to Severance for a factory regrind job.

Severance

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WITH GISHOLT IMPROVEMENTS IN METAL TURNING

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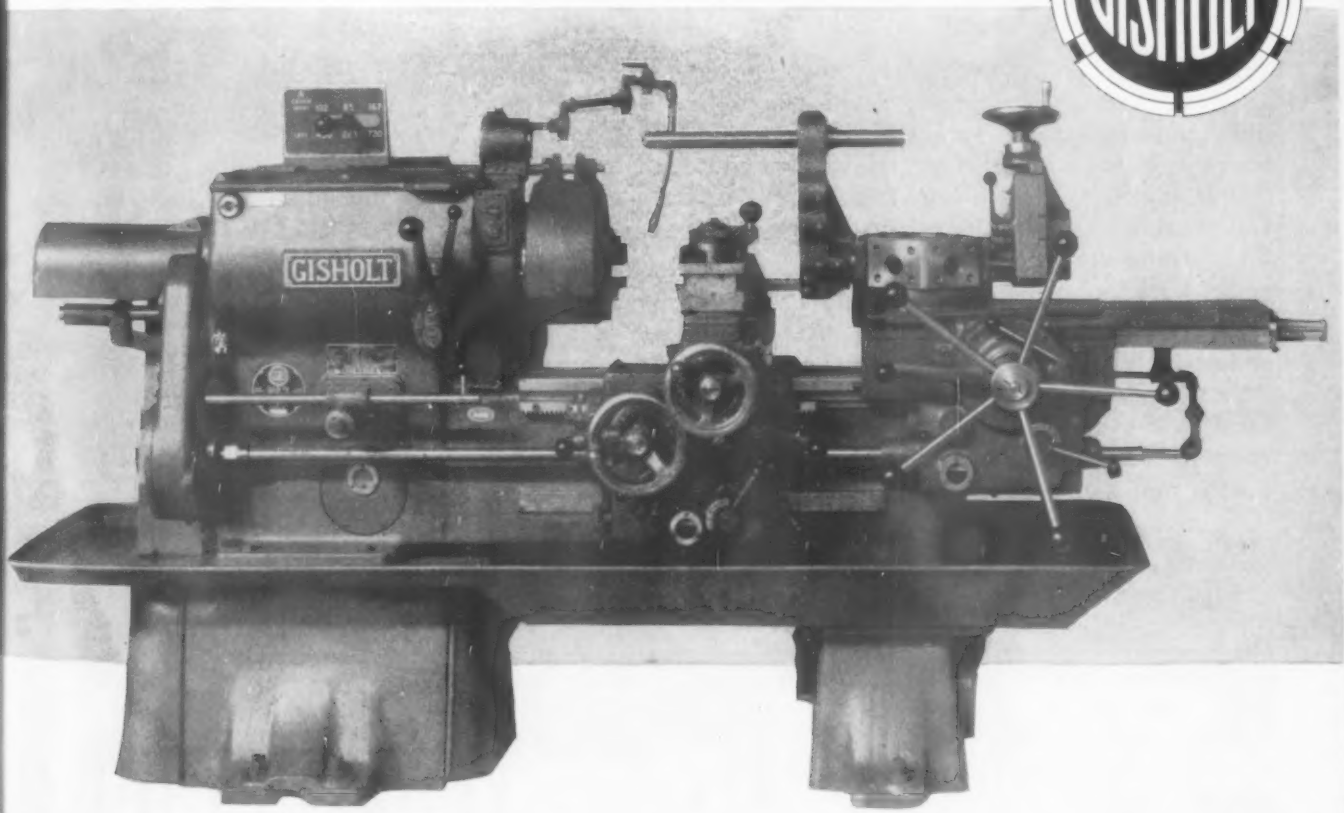


TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

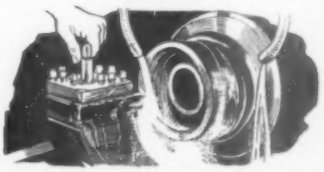
KEEP PRODUCTION *Up* AND INVENTORY *Down*

use TECO *Cemented Carbide!*

War requirements stress the need for peak production; changes in production emphasize the need for low inventories. You accomplish *both* by using TECO Cemented Carbide for turning, boring and facing operations. Each tool stays on the job much longer, produces more pieces, needs fewer replacements. Thus, you raise your production to higher levels, while maintaining low tool inventories.

TECO Cemented Carbide has resistance to wear and breakage in an advanced degree, through controlled hardness, density and uniformity of structure. Comparative job records consistently show sharp increases in production per tool when TECO Cemented Carbide is used—a fact you can prove on your own machines. Write for catalog and new price list covering tools and blanks in a wide range of grades, styles and sizes.

CUT *MORE* STOCK HERE



CARRY *LESS* STOCK HERE

TUNGSTEN ELECTRIC CORPORATION, 570 39th Street, Union City, N.J.

Representative: Architects & Builders Bldg., Indianapolis, Ind.
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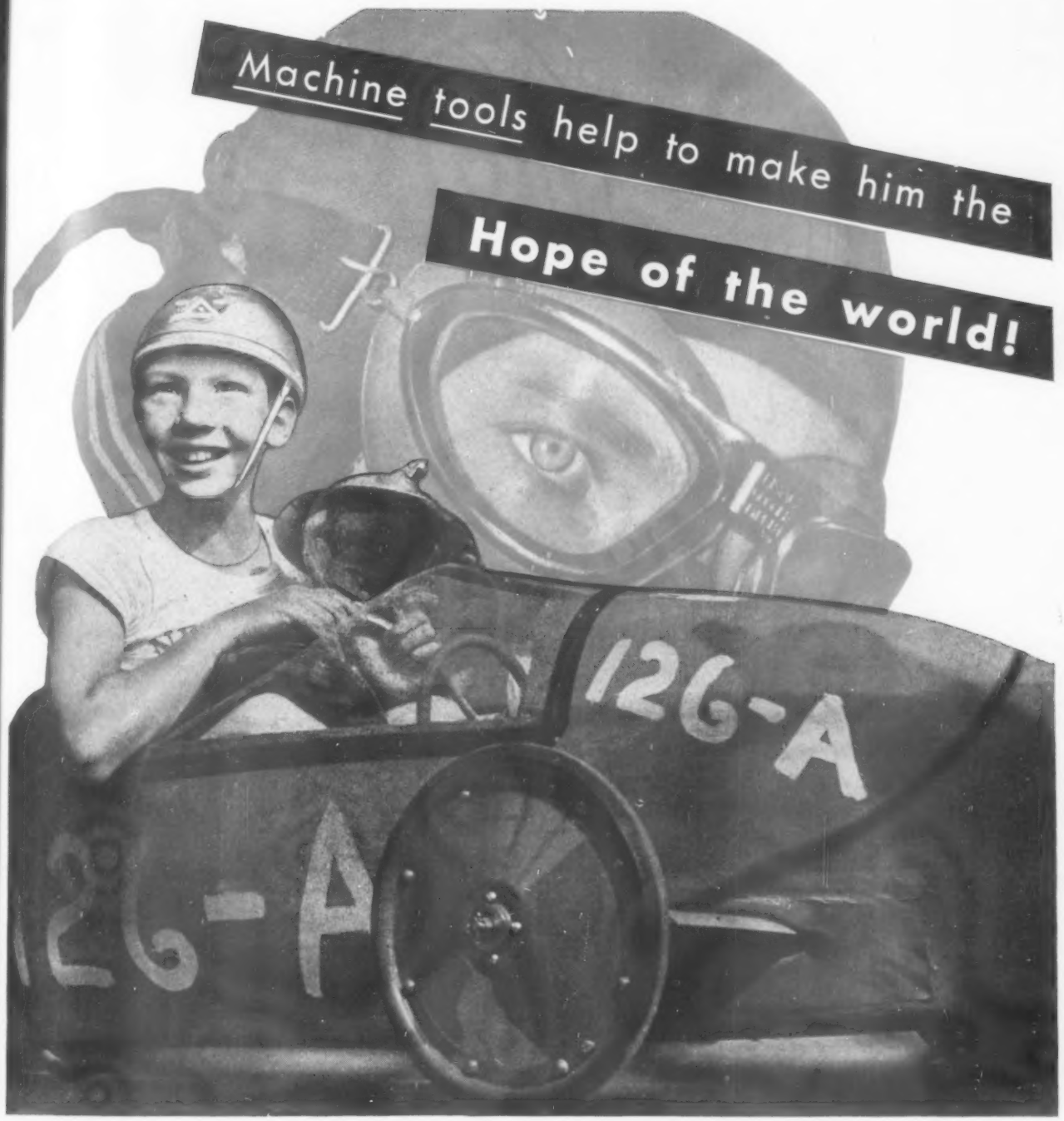
TECO

Pioneers in Tungsten Carbides for over a Quarter Century

TECO

CEMENTED CARBIDE



Meet "Flash" Jonesey, champ of the soap box derby. He built that job with his own two hands and his old man's basement tools. . . . He's the great American dream, and the hope of this cockeyed world.

For it's because America raises kids like Jonesey that America is winning this war. Kids who were weaned on mechanical toys, and cut their eyeteeth on tools. Kids who grew up to be the finest fliers and fighters, engineers and builders the world has ever seen. . . . And it's because of millions of kids like Jonesey that America will have a priceless legacy of the world's finest skills, after this war is won.

The responsibility to use those skills wisely and well is one of the greatest industrial challenges ever to face this nation.

If you are a manufacturer, there is one thing that you can do at once: Have your production men and planners consult now with the engineers of the basic machine tool producers. They can help you in planning ahead the difficult task of reconverting your own skills and machinery to an all-out peacetime production.

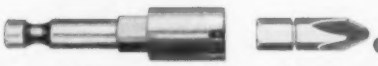
One of these engineers is a Bryant man — and his specialized knowledge of internal grinding machinery is important to the manufacture of literally *everything* that will mean jobs and prosperity after the war . . . that will make America's priceless legacy a new hope for the world.

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U. S. A.

"I got my choice of two bumper crops!"

Here's not one, but *two* right answers on how to get more power bits for less!

FIRST, you can use the regular Apex-Phillips screw driver bits, and when they get worn just send 'em back to the factory and have 'em reconditioned. The cost is a small fraction . . . generally less than one-third . . . of the new bit price. AND renewed Apex bits are good as new, which is plenty good, because they're made of fine steel, heat treated for the right combination of strength and hardness. Get the full story in Catalog No. 15.



OR you can use the new Insert Type Apex bits, with Apex holders. Holders are supplied to fit practically every type and make of power driver. And the holders accommodate the short, money-saving, steel-saving bits in a full range of sizes. You trim your inventory because a few bit sizes fit all holders. You save substantial money. Get the facts in Bulletin No. 102. So take your choice, and either way, make it Apex-Phillips screw driver bits.

APEX

THE APEX MACHINE & TOOL COMPANY • DAYTON 2, OHIO

Today while you are engaged in war work, NUBON grinding wheels save vital hours in delivery speed. Ten day delivery is guaranteed—even faster service in emergencies. This, plus jewel-like precision, is the result of our now famous *Controlled Trial Plan* of engineering, and our *Special Bonding Process.*

When war contracts are cancelled, and plants reconvert, those who use NUBON Wheels will not be handicapped with big inventories of useless wheels. For fast NUBON service eliminates the need of *ever* carrying large stocks of grinding wheels.

You are assured of accurate, uniform grinding wheels to solve your individual problems, quickly . . . economically. Speedy NUBON service is gaining wider and wider recognition among industrial leaders for *immediate and post-war needs.*

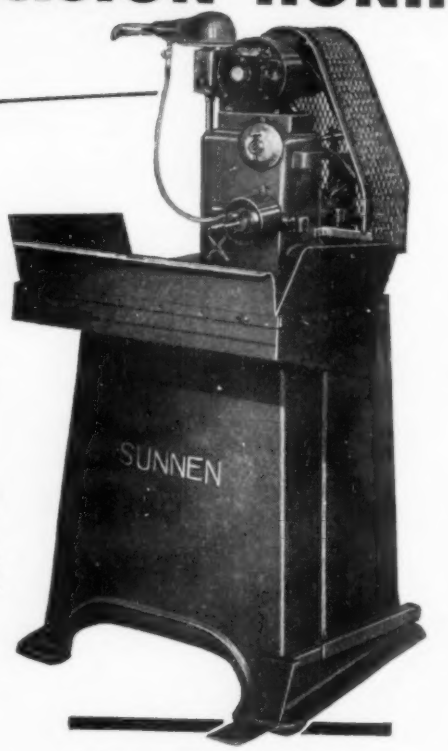
Send for your copy of our catalog.

UNIVERSAL WHEEL & ABRASIVE CORP.

2626 West Van Buren Street, Chicago 12, Illinois

NUBON 24 HOUR PROCESS GRINDING WHEELS AND STONES

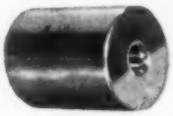
YOU GET EVEN GREATER ACCURACY— FASTER HONING with the IMPROVED SUNNEN PRECISION HONING MACHINE



Sunnen Precision Honing Machine handles any internal diameter from .185" to 2.625" in any metal or plastic except lead and babbitt.

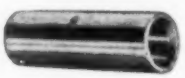
Typical Jobs

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping—and gave a straighter hole.



Header Die. Life of header die's increased 3 to 9 times over lapping. Knock out pin breakage practically eliminated.

Aircraft Instrument Panel Control Wire Bushing. Hole .187" diameter—held to .0002", stock removal .001", sixty per hour.



Aircraft Piston Pin. Sunnen honing is twice as fast and gives a cleaner, better looking pin.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Aircraft Carbureter Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Roller Bearing Outer Race. Finish improved from 12 micro-inches to 2 micro-inches.

Bearing. A very small part. 2 micro-inch finish necessary.

Cast Iron Valve Stem Guide. ½ to one thousandth removed—220 pieces per hour. Better finish and straighter hole.

Carbureter Idler Valve Jet. Hole is honed after reaming for smooth action.

Shell Loading Die.

Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.

SUNNEN

The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

A new base, including a pump for providing a constant flow of honing fluid to the honing mandrel and stone. The flow of honing fluid acts as a coolant, carries away cuttings, and keeps the stone in sharp cutting condition. Accuracy and honing speed are considerably improved.

Adequate settling basins and baffles are provided so that no cuttings or abrasive can be pumped into the fluid lines. Flow-back pans are adjustable so that they do not interfere with the work. Pumps and coolant tank capacity are adequate to supply a constant flow of fluid.

In addition, a machine light is furnished for inspecting finish of work and for gaging completed parts.

The Sunnen Precision Honing Machine provides absolute interchangeability of parts because tolerances can be held to well within .0001" and produce holes that are honed straight and true without taper or bell-mouth.

Parts last longer because it produces a super-smooth finish of from 2 to 3 micro inches. It's easy to set up and does not require skilled labor for operation.

Write for free bulletin—or ask a Sunnen engineer to give you complete information on how Sunnen honing can be used in your plant.

SUNNEN PRODUCTS COMPANY — 7932 Manchester Avenue, St. Louis, Missouri

Canadian Factory: Chatham, Ontario

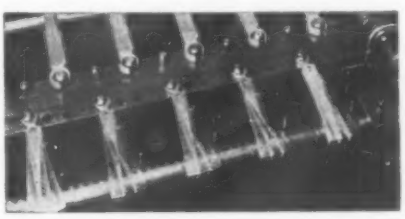
RIGHT ON THE MONEY
here's proof of proper torquing...
Here is the Chapman Torque Calibrater distributed by Tubing Seal-Cap Inc. It measures torque within *1 inch-ounce.* Each Livermont Torq-Stop Wrench is set and tested for accuracy on this precision scale to a point where the beam balances. A five cent piece is then placed on the counterpoise as a no-go. The wrench must not break the beam with the addition of this small weight. It must be "right on the money."

TORQUING "RIGHT ON THE MONEY"

with the world's easiest-to-use torque wrench—a recommended S. A. E. standard

Now nuts, bolts, clamps and fittings can be tightened to their safe, proper torque "right on the money" by unskilled help.

The accurate, sturdy, compact Livermont Torq-Stop Wrench is a production line tool that increases output, assures correct torquing (within 2% plus or minus). No dials, no batteries—nothing to watch. It gives an audible "click" and a definite physical sensation is transferred to operator's palm when proper torque is reached. Used by most aircraft companies and hundreds of production plants. Society of Automotive Engineers' recommended dimensions.



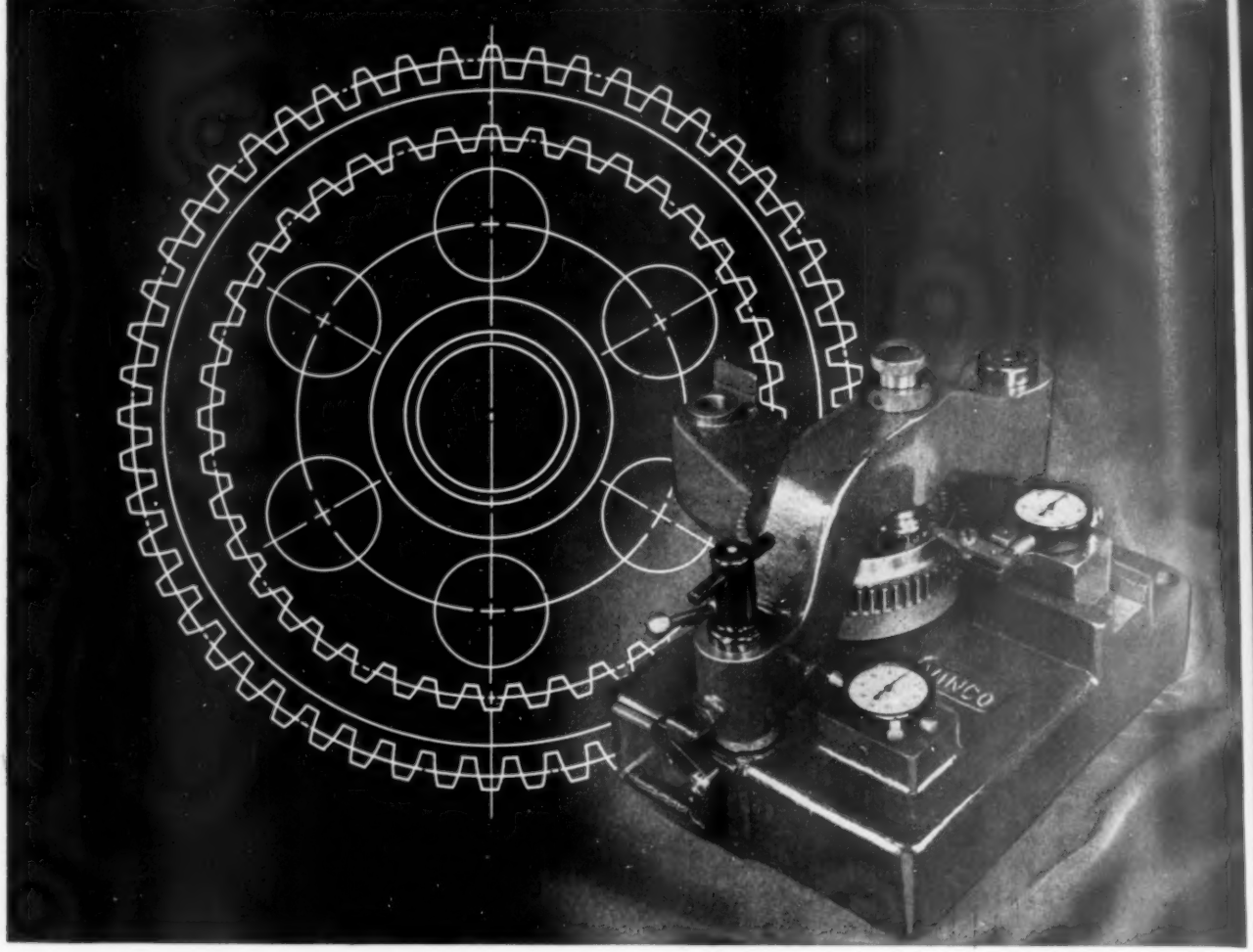
Tools Are Weapons—Treat 'Em Right.

10,000 OPERATIONS BEFORE FINAL APPROVAL. This is the Livermont Torq-Stop Wrench Break-In Table. Each Wrench after being set to its proper torque is operated through 10,000 consecutive cycles. When the 10,000 operations are complete the Wrench is removed and tested. It must not have varied over 2 inch-pounds during this test. It is then sealed at its proper predetermined torque for the job for which it was ordered.

Send today for 36 page illustrated Aircraft Tubing Manual.

LIVERMONT *torq-stop* WRENCH

A ~~CHAIN~~ Gear IS ONLY AS STRONG AS ITS WEAKEST ~~LINK~~ tooth



Appropriate apologies for paraphrasing an old proverb! But isn't it the truth?

There is no provision today for error. There is too much at stake. Highly mechanized warfare staged against a bitter, ruthless enemy demands a constant flow of war machines, flawless in construction and exact in every detail. Gears furnish the vital motive power for these engines of destruction—gears decide whether we can out-shoot, out-fly or out-maneuver the enemy. That is the gear maker's responsibility.

VINCO also has a responsibility: to provide speedy, accurate methods of checking the various phases of gear production. VINCO GEAR ROLLING FIXTURES, VINCO MASTER GEARS and the VINCO INVOLUTE CHECKER are doing a masterful job in helping to maintain peak gear production.

The above insert is a Vinco Gear Rolling Fixture designed to check backlash and run-out on an internal gear—one of hundreds of specially designed gear rolling fixtures that are proving invaluable aids to leading manufacturers in maintaining a high production of precision gears.

VINCO CORPORATION
8857 SCHAEFER HIGHWAY - - DETROIT 27, MICHIGAN

SALES OFFICES
NEW YORK and CHICAGO

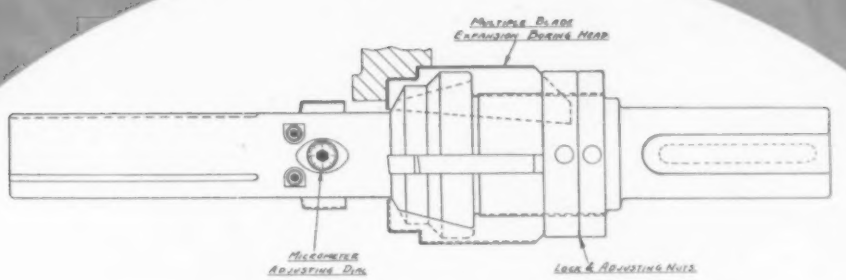
MILLIONTHS OF AN INCH FOR SALE BY VINCO

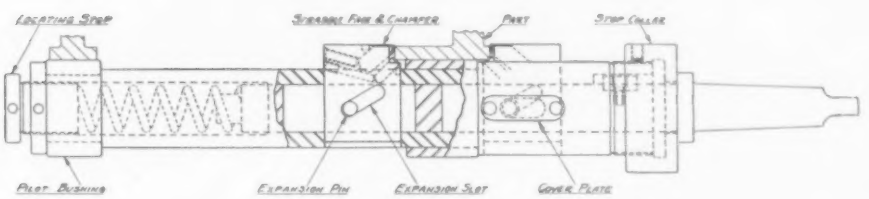
Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development.

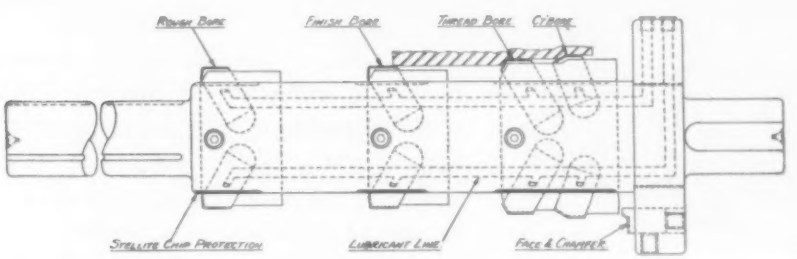
For Amazing NEW STANDARDS of ACCURACY·SPEED·ECONOMY

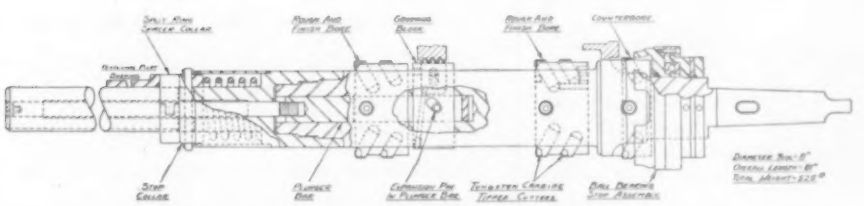
DAVIS BORING TOOLS

Specially Designed for All Types of Boring









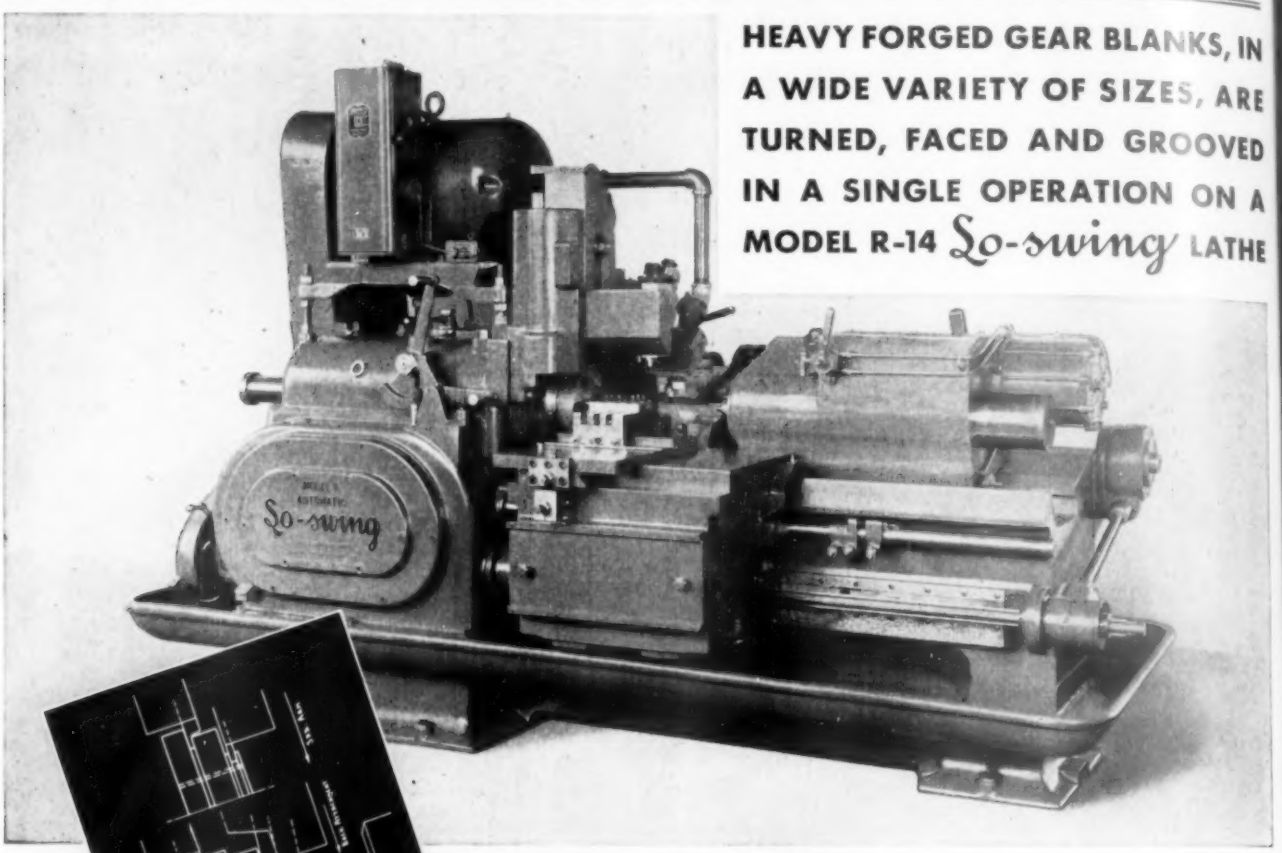
Send us prints of your work and, without obligation, we'll prepare for you a helpful, specific recommendation. Write us today. 6200 Maple Ave., St. Louis 14, Mo.

DAVIS BORING TOOLS

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE *Lo-swing* PEOPLE"** SENECA FALLS, NEW YORK

HEAVY FORGED GEAR BLANKS, IN A WIDE VARIETY OF SIZES, ARE TURNED, FACED AND GROOVED IN A SINGLE OPERATION ON A MODEL R-14 *Lo-swing* LATHE



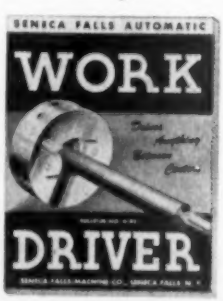
PROBLEM: To provide a single automatic lathe capable of turning, facing and grooving a variety of sizes of heavy steel gears and requiring minimum change-over time from job to job.

SOLUTION: The R-14 *Lo-swing* Lathe was chosen for this job primarily because it had the power and capacity necessary to handle heavy steel gears, varying in size from 4¾" to approximately 10" diameter. The built-in, Quick Change-over Mechanism on this lathe also provided a simple and speedy means for varying the carriage stroke, as required for each individual gear job.

Forged gear blanks come to the lathe with only the hole finished. Drive is by arbor through this hole as seen in the drawing above which illustrates typical tooling for one of the gears.

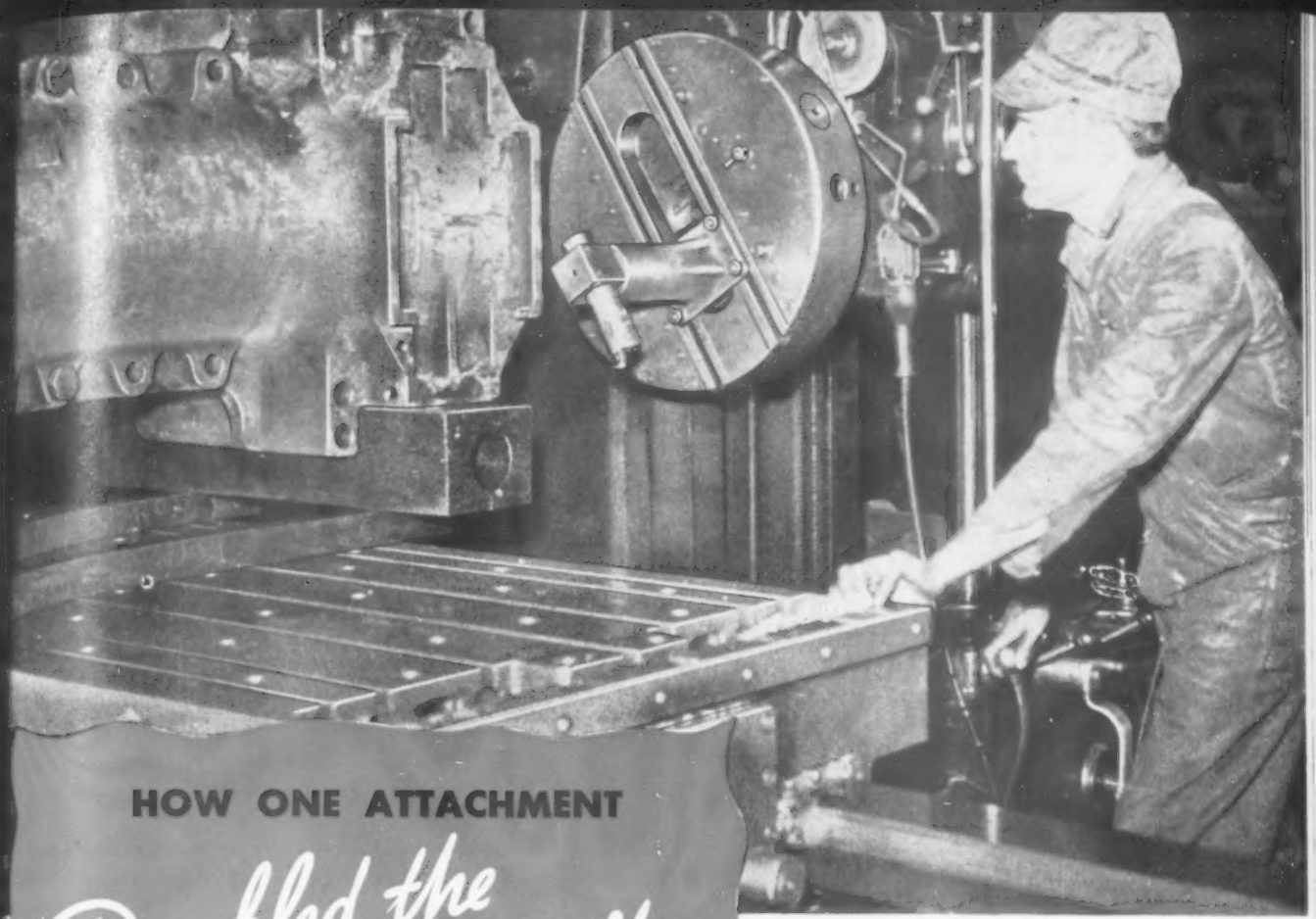
In order to simplify tooling, this Model R-14 *Lo-swing* was equipped with a standard Third Slide or Overarm which carries the grooving tools. Turning is accomplished with the Front Carriage tools while tools on the Back Attachment face the sides of the gears.

Have You Received Your Copy?



Bulletin D-43 describes 18 standardized models of this time and labor-saving Work Driver. Write for your copy today. Seneca Falls Machine Co., Seneca Falls, N. Y.

LATHE NEWS from SENECA FALLS



HOW ONE ATTACHMENT

Doubled the Capacity

OF THIS BORING MILL

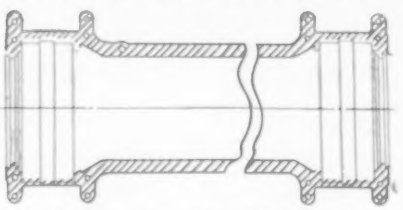
G. & L. Continuous Feed Facing Head Cuts Machining Time from 60 to 30 Hours...

A Giddings and Lewis Continuous Feed Facing and Boring Head, used with a G. & L. Table Type Horizontal, cut the rough and finish boring and milling of a bearing retainer for a locomotive axle housing to 30 hours—30 hours less than the previous time on the same machine without this attachment.

This G. & L. machine is saving set-up and machining time on a wide range of production and maintenance jobs in this railroad shop. On routine maintenance work, such as reboring main connecting rods to compensate for wear, setups can be made in eight to ten minutes and boring completed in five minutes. Savings of 50% in floor-to-floor time are common on all types of boring and milling jobs.

Investigate the possibilities of a G. & L. Horizontal Boring, Drilling and Milling Machine. Giddings and Lewis engineers will be glad to work out practical solutions to your machining problems. Perhaps the addition of the continuous feed facing head or some other simple attachment will increase the flexibility of your boring mill. Call on our engineers for their recommendations. There is no obligation.

How This Job Was Done

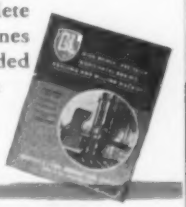


In machining this bearing retainer for a locomotive axle housing, the two halves of the housing were bolted together and mounted on a locating fixture on the machine table. The work was strapped down by bolts through the bolt holes of the split half.

All roughing and finishing operations on one end of the part are completed first, then the part is reversed and the same operations repeated on the opposite end. Speeds of 10 r.p.m. and feeds of ¼" are used on both roughing and finishing. Standard ½" tool bits ground with ⅛" and ⅜" radii are used to machine this part.

This bearing retainer was originally machined in 60 hours floor-to-floor, on the same G. & L. Horizontal without the facing head. The use of the G. & L. Continuous Feed Facing and Boring Head enabled the operator to save 30 hours machining time and obtain more accurate production.

Additional Data covering the complete line of Giddings and Lewis machines and time-saving accessories is included in this catalog. Write today—please indicate your business connection. Ask for Bulletin No. TE 54.



GIDDINGS & LEWIS·MACHINE TOOL CO.

132 DOTY STREET, FOND DU LAC, WISCONSIN

When you want more than prints of your drawings

Getting your drawings into print form...and to the men on the assembly line . . . is probably your first concern.

You are sure of faster results, and better prints, *when you have an Ozalid machine.*

You know, also, that you're equipped for more than "ordinary printmaking". . . and that you can save time, labor, and materials—in print production. . . in the drafting room . . . throughout your organization.

You receive "extra values" because Ozalid is different from any other reproduction process. The *big* difference being OZALID DRY DEVELOPMENT.

IF YOU'RE NOT USING OZALID

- ▶ You can add an Ozalid Dry Developer which can be used with your present printer.
- ▶ You can order an Ozalid whiteprint machine which incorporates printing and dry developing units.

There's a machine designed for your print production requirements. When it's installed—you'll have *more* than a printmaking process.

EXTRA VALUES YOU RECEIVE WITH OZALID

• Ozalid Dry Development

Eliminates water and potash baths, driers, multiple controls. All types of prints are produced in the same operation—no "stops" in production. "Skilled Help" is no longer a printmaking requirement.

• Complete Line of Sensitized Materials

Papers, cloth, and foils can be processed—an impossibility with other methods. These are available in cut sheets as well as roll stock—thus you can eliminate trimming waste.

You can make prints having black, blue, or maroon lines on a white background. You can assign identifying colors to prints of different departments, distinguish checked from unchecked prints, etc.

• Ozalid Transparent Duplicates

May be substituted for valuable originals in subsequent print production . . . or employed by draftsmen to eliminate retracing when making design changes.

• Ozalid Foils

May be used to reclaim soiled or worn originals, to make composite prints...or fast printing "duplicate" originals.

• New Ozalid Rapid Black

Hailed by reproduction men as the finest dry developing paper ever made. Recommended for reproducing pencil drawings, typed material, and for printing from photographic positives.

For complete information, write for Catalog and samples of Ozalid Whiteprints.

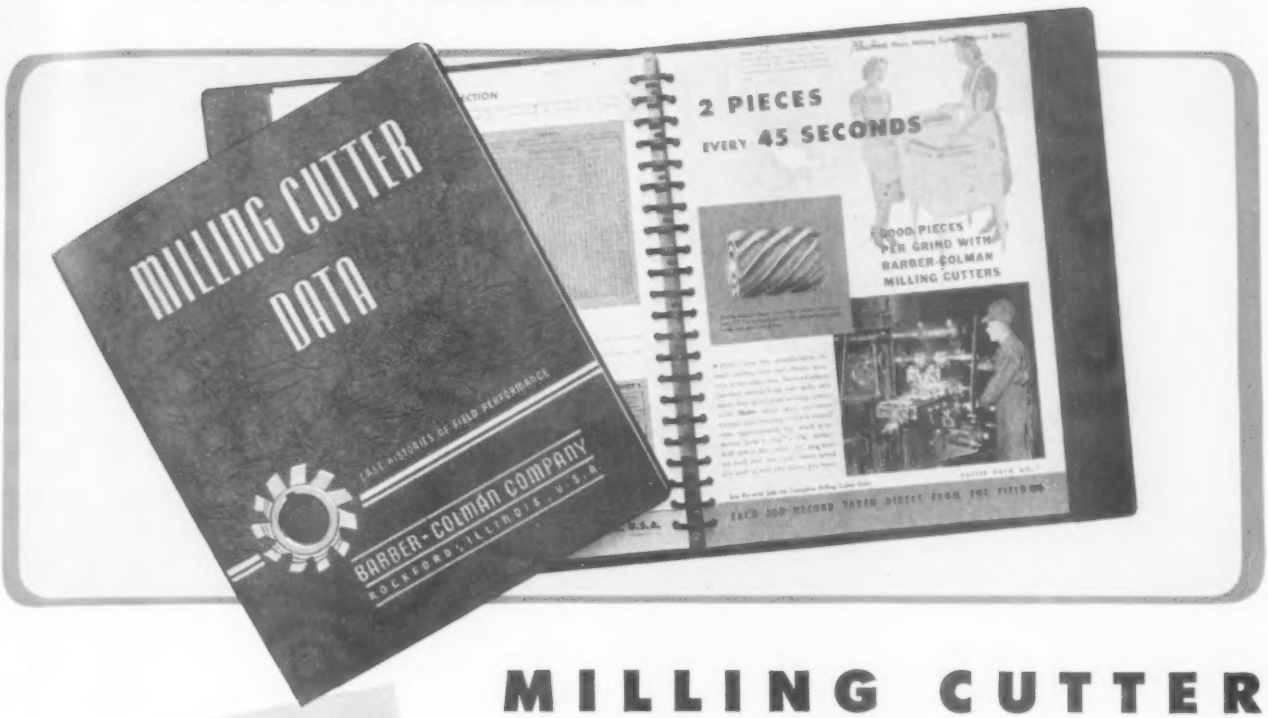
OZALID PRODUCTS DIVISION

GENERAL ANILINE & FILM CORPORATION

Johnson City, New York

OZALID IN CANADA—HUGHES OWENS CO., LTD., MONTREAL

A NEW BARBER-COLMAN SERVICE...


MILLING CUTTER DATA
CASE-HISTORIES OF FIELD PERFORMANCE
BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS, U.S.A.
2 PIECES EVERY 45 SECONDS
2000 PIECES PER GRIND WITH BARBER-COLMAN MILLING CUTTERS

MILLING CUTTER DATA SHEETS

These performance data bulletins are offered to help you obtain maximum cutter efficiency and economy by bringing you first-hand case-history information direct from the field. From these examples of how other manufacturers are using B-C Engineering Service and cutters you can obtain many profitable ideas that will be useful in solving your own metal-cutting problems. For a number of years we have been publishing a similar service, Hobbing Data Sheets, which have been enthusiastically received and profitably used by our hob customers — these new Milling Cutter Data Sheets will provide similar valuable information for our cutter customers.

SUPPLEMENTING OUR EXPANDED ENGINEERING SERVICE...

In recent months we have extended our consultation service on cutting tool problems to include full-time men who are experienced on Milling Cutter problems of all kinds. The services of these men are available to you without obligation — and the Data Sheet service described here will illustrate many of the problems they have successfully solved.

HOW TO OBTAIN A COPY

Distribution of Milling Cutter Data Sheets, including a loose-leaf binder and periodical issue of additional sheets, is without charge or obligation, but is limited to superintendents, master mechanics, production supervisors, and others in similar responsible positions. To place you on our list, we must have a request written on your company letterhead and signed by a person of suitable authority.

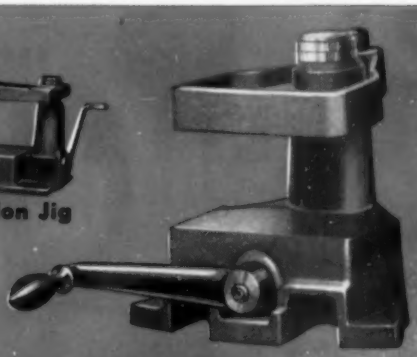
Buy War Bonds and Stamps

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

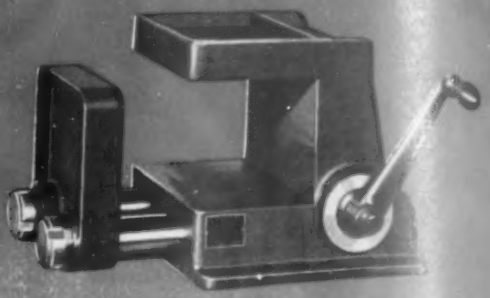
Barber-Colman Company

GENERAL OFFICES AND PLANT • 105 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

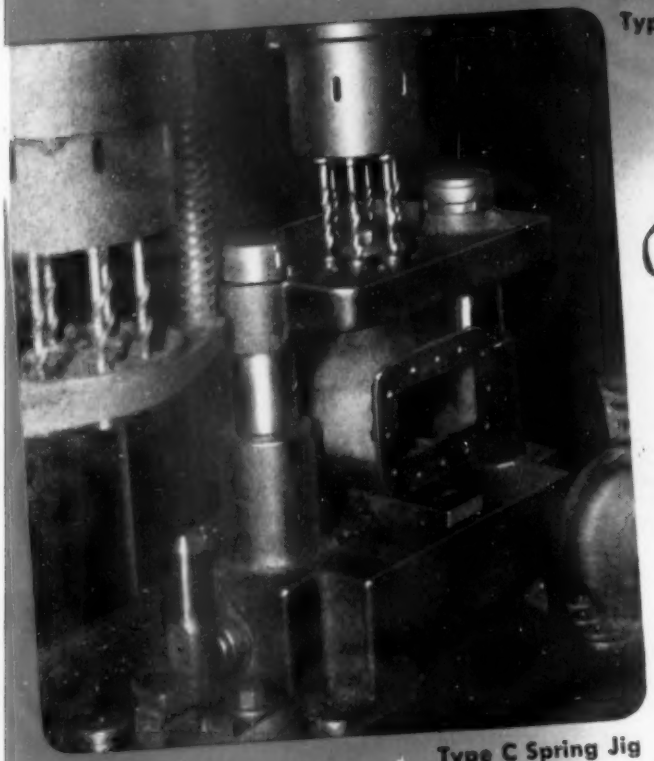
Type C-L Rack and Pinion Jig



Type E Spring Jig



Type H Horizontal Rack and Pinion Jig for 2-way Drilling



Type C Spring Jig

FROM NOW ON

Production Economies Count

SAVE TIME, LABOR, MATERIAL, MONEY

with

SIEWEK

STANDARD RAPID CLAMPING DRILL JIGS

Spring or Rack and Pinion Types—Square or Oval Top Plates—Wide Range of Sizes

Type D Spring Jig

Type B Jr. Spring Jig

● Siewek Rapid Cleaning Drill Jigs, speeding the production of war goods in factories all over the country, are saving precious time, material and labor in the shop.

These standard jigs and adapters are easily and quickly set up—instantly ready to work on any particular part. The simple, material saving adapters are easy to make in your own toolroom in as great a variety as there are jobs.

It will pay you, in increased production, to investigate now the many advantages of Siewek Rapid Clamping Drill Jigs. Contact a Siewek representative in your territory, or write us. *Send for Catalog No. 50J.*

Affiliated with Siewek Engineering Division, **a nationally known organization staffed with experienced engineers—Consulting, Processing, Designing, Fabricating and Efficiency Methods**

SIEWEK TOOL DIVISION
of Domestic Industries, Inc.
Detroit (Ferndale Station) Mich.
Representatives in Principal Cities

Manufacturers of
PROGRESSIVE SHEAR-CUT END MILLS

Grinds BOTH SIDES PRECISELY PARALLEL

Simultaneously

DOUBLE SPINDLE DISC GRINDER

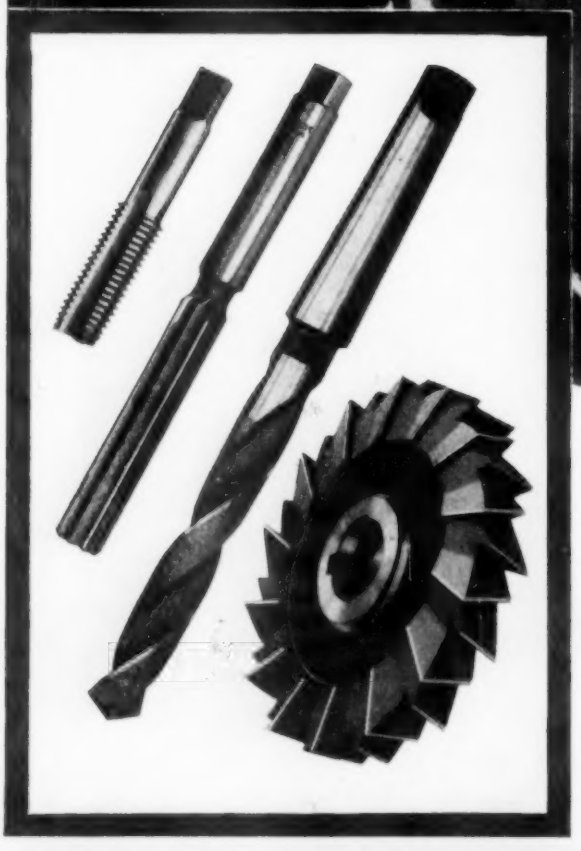
Parallel grinding problems are solved with high speed accuracy on this Hanchett machine, popularly known as the "Badger". Work to be ground is held in a suitable fixture and is passed by hand or power between two parallel grinding wheels. The drums shown in this work picture are typical of the infinite variety of parallel grinding jobs accomplished on this versatile grinder. For complete information write today for Bulletin 170T-7.

HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

DEPENDABLE . . .



. . . so are MORSE TOOLS

That's why Morse Tools help to increase production.

TOOLS ARE WEAPONS - - - TREAT 'EM RIGHT!

MORSE THERE IS A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

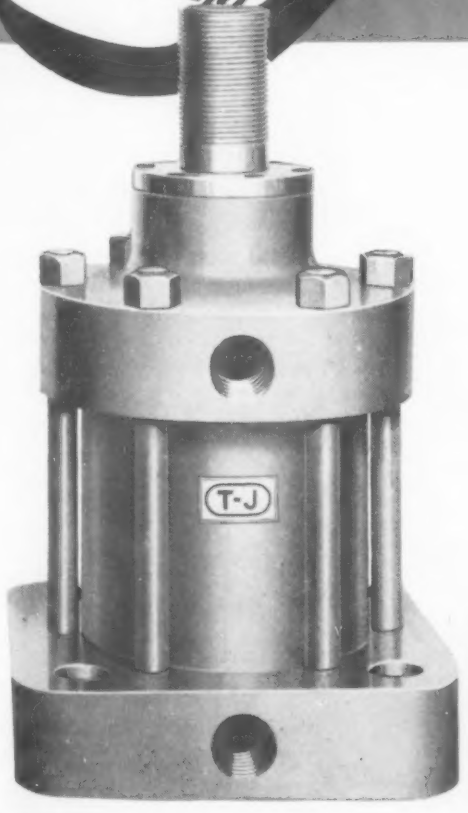
NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

FOR 100 LBS. POWER MOVEMENT

"Tailored to the Job-"

FOR EFFICIENT POWER MOVEMENT IN ANY DIRECTION

...OR 50,000 LBS. POWER MOVEMENT



Big or little jobs for "mechanical muscle"... are handled with TOP speed and efficiency by T-J Air and Hydraulic Cylinders!

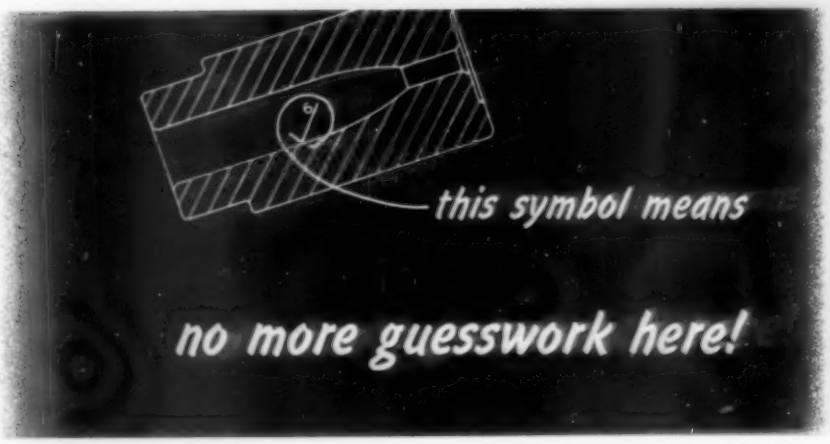
They're ruggedly built to "take it"... with bodies honed to accurate concentricity and straightness... all mounting surfaces strictly inspected for squareness and smoothness... one piece piston construction for greater dependability.

T-J AIR CYLINDERS exert power movement from 100 lbs. to 12,000 lbs. (direct). T-J HYDRAULIC CYLINDERS exert power movement from 1000 lbs. to 50,000 lbs. (direct). Available in sizes, styles and strokes to meet your requirements. Precision-manufactured and expertly engineered with T-J's quarter century experience. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS



THE ENGINEER, by using this symbol (or one of its variations), is specifying a definite surface finish measured in microinches. He has eliminated the guesswork that for years went into production of satisfactory surface finishes.

The engineer need no longer rely on the designation "*f* = smooth machined surface . . . " which he knows may produce as many different surfaces as there are men in charge of making the part.

And in preparing his specifications, the engineer can call for the surface most suitable for the work the part has to do. Very close tolerances can be set for the production of very smooth surfaces—or of rough surfaces where a pre-defined roughness is wanted.

The Profilometer* has enabled the simple, accurate measurement of surface roughness—making possible the fullest use of the roughness symbol shown. With the Profilometer, each part may be accurately checked on a production basis to make sure it meets blueprint specifications for surface roughness.

Roughness control by means of Profilometer readings has facilitated finishing to dimensions, prevented waste of materials and time, and enabled production of better surfaces on millions of machined parts going into war machines. Wartime experience in this regard indicates extensive application of surface-roughness control in peacetime manufacture. Inquiries are invited from manufacturers looking ahead to peacetime production.

The Profilometer . . .

The basic Profilometer unit is a complete shop instrument for measuring average surface roughness. Nearly all surfaces can be measured with this unit. This unit is supplemented by standard accessories available in the form of extra Tracers, piloting fixtures, and other devices to facilitate production measuring on very smooth surfaces, odd-shaped surfaces, and in slots, grooves, small holes and on tapers.

Our Application Engineering Department is fully equipped for the design and manufacture of special jigs and fixtures where standard equipment is not adaptable.

To help you with your surface-roughness problems, we would be glad to demonstrate the Profilometer equipment in your plant and on your parts, at your convenience and at no obligation to you.

May we send you a copy of our booklet *Practical Measurement of Surface Roughness*? In it is described the technic of surface-roughness measurement and the complete Profilometer equipment.

*Profilometer is a registered trademark indicating Physicists Research Company's brand of surface-roughness gaging equipment

PHYSICISTS RESEARCH COMPANY
343 SOUTH MAIN STREET · ANN ARBOR, MICHIGAN

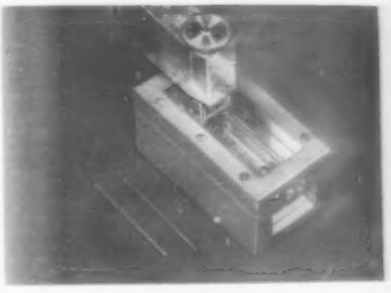
Engineering Service for Profilometer Users

Special problems in surface-roughness measurement are being handled in ever-increasing number by the Application Engineering Department of Physicists Research Company.

Despite the extensive range of Profilometer accessories, surfaces are occasionally encountered which require special equipment for their measurement. In this

department, individual fixtures and accessories are developed to apply Profilometer equipment to the roughness-measurement of these surfaces.

The complete fixture or accessory is designed and built in our own laboratories and shops, and is developed for use with standard Profilometer units for greater versatility.



Illustrated are examples of work done in this department. The upper photograph shows a small wedge made to hold the Tracer at an angle in the Type A Piloting Fixture to give access to a recessed surface. The lower picture shows a simple guiding fixture for the measurement of small pins, where the skids of the Tracer could not be gotten on the part.

A representative of Physicists Research Company is ready at any time to help with special surface-roughness measuring problems. Your request to have him call will incur no obligation.

Physicists Research Co.
343 S. Main St., Ann Arbor, Mich.

P&J ... RE-TOOLING

will re-convert YOUR MACHINES for MAXIMUM PRODUCTION and ECONOMY . . .

FROM THIS PRE-WAR JOB

The P & J No. 6-DREL Automatic Chucking & Turning Machine shown here was tooled for producing valve bonnets used in oil well equipment. Operations included through hole drilling, rough and finish boring and facing, chamfering, undercutting, tapping, threading and turning to size. Heavy lines shown on drawing of part show machined surfaces. Production: 4.6 pieces for 51 minute-hour.

TO YOUR POST-WAR REQUIREMENTS

P & J machines now on war work can be adapted to postwar work with assurance that when the retooling job is engineered by Potter and Johnston tooling experts, the maximum in production, convenience, accuracy, and economy will be attained. P & J's 45 years experience in designing tool set-ups combined with the versatility in tooling possibilities available in P & J Automatics means that you have, through P & J, an invaluable service at your disposal for utilizing your P & J Machines to greatest possible advantage on post-war work.

If you are planning for tomorrow's requirements and are concerned with the problem of achieving low cost production of duplicate parts, now is the time to explore the possibilities offered through P & J RE-TOOLING SERVICE. Investigate Today!

P&J

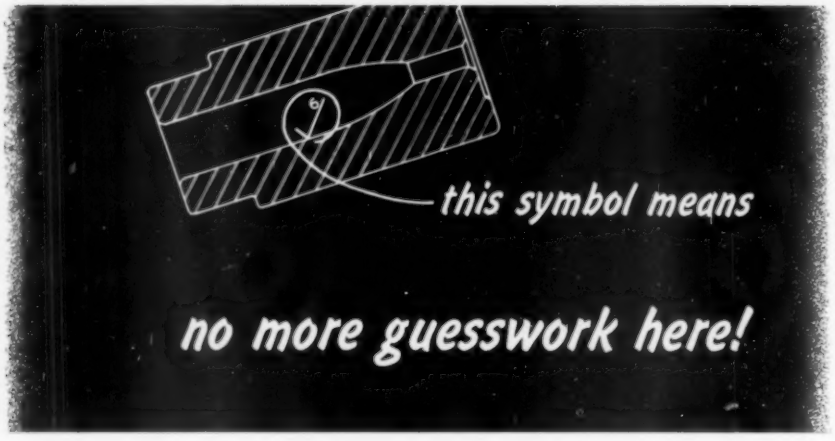
REBUILDING SERVICE

P&J is equipped to take our customers' present P&J Automatics and thoroughly rebuild them and return them to their owners completely restored to original productivity and accuracy. Re-tooling can also be handled conveniently while machines are in our shop for rebuilding.

Every Bond You Buy is an Investment in Freedom

The POTTER & JOHNSTON MACHINE CO.

.....Pawtucket, R. I.



THE ENGINEER, by using this symbol (or one of its variations), is specifying a definite surface finish measured in microinches. He has eliminated the guesswork that for years went into production of satisfactory surface finishes.

The engineer need no longer rely on the designation "*f* = smooth machined surface . . . " which he knows may produce as many different surfaces as there are men in charge of making the part.

And in preparing his specifications, the engineer can call for the surface most suitable for the work the part has to do. Very close tolerances can be set for the production of very smooth surfaces—or of rough surfaces where a pre-defined roughness is wanted.

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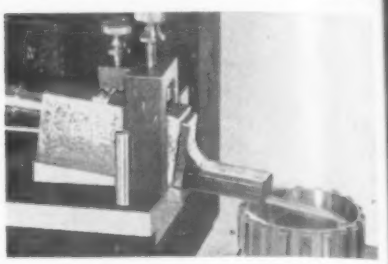

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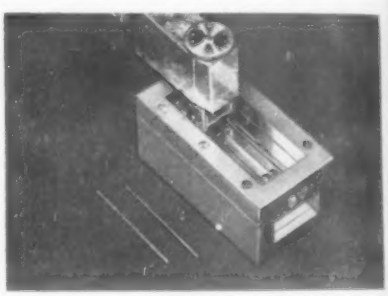

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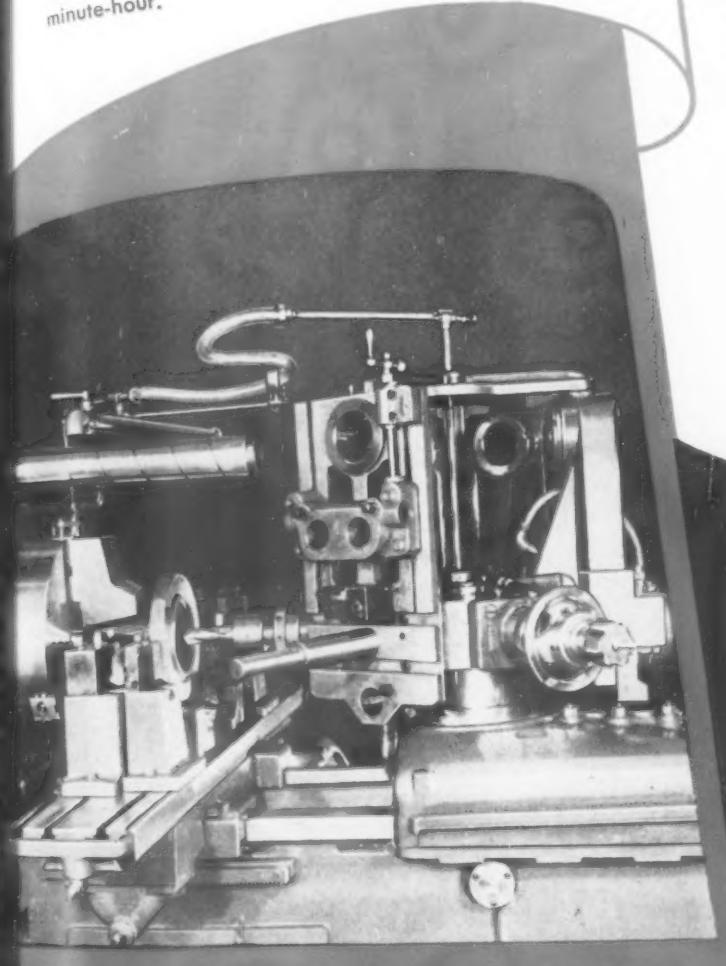

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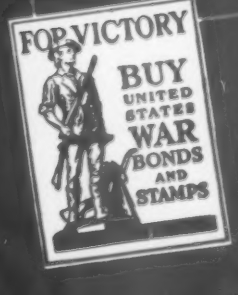


Every Bond You Buy is an Investment in Freedom

The POTTER & JOHNSTON MACHINE CO.

. . . . . Pawtucket, R. I.

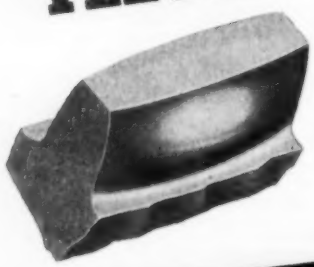
Compare

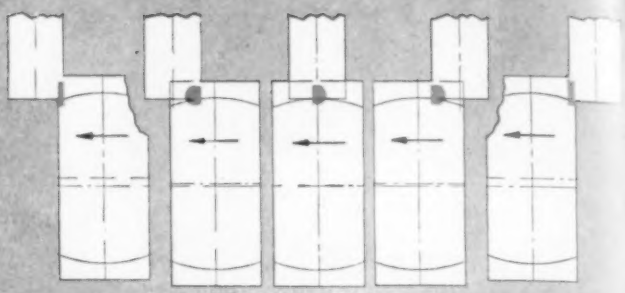
THESE METHODS OF SHAVING

ELLIPTOID

(CROWNED)

TEETH

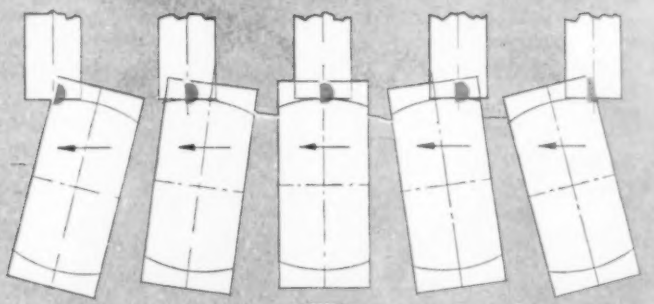




CAM IN-FEED . . . Not Recommended

Here cutting is done by the unsupported edge of the cutting tool except at the point of maximum tooth thickness. As the cutter moves away from this point, it produces steps or chatter marks in the tooth surface on the downhill side of the cut.

Cutting serations are not tangent to the point of contact when crowning.



RED RING METHOD

(DESIRABLE)

In the RED RING method, cutting clear across the tooth face is done by the central zone of the cutter at the intersection of its axis with that of the work gear where maximum control and smoothness is assured. The amount of crown can be varied to accommodate any particular application.

Cutting serrations are always tangent to the point of contact, thus assuring maximum machine cutting efficiency.

Write for descriptive bulletin on the RED RING Shaving Machine.

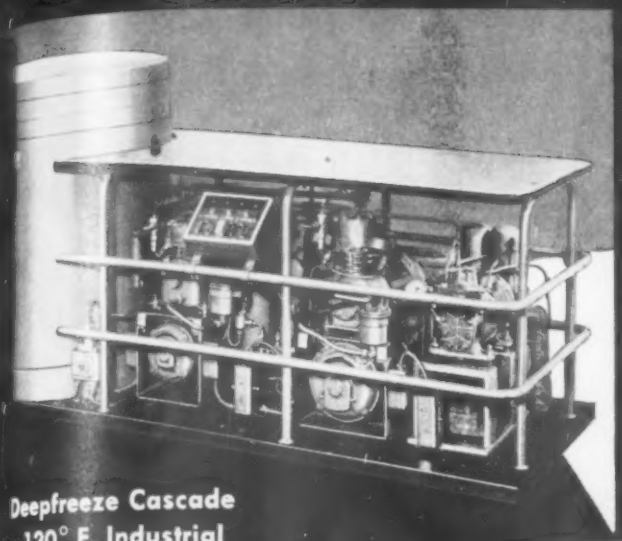
SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

5600 ST. JEAN · DETROIT 13, MICH.



Deepfreeze Cascade
−120° F. Industrial
Chilling Machine

Does This Answer Your Questions About The NEW Deepfreeze Process for Cold Treating Metals?

What Is the Deepfreeze Process?

It is the application of Deepfreeze Industrial Chilling Machines for the hardening, seasoning, shrinking and testing of metals by freezing at temperatures down to −120° F. This process involves a new principle of refrigeration, which permits faster, more efficient heat removal.

What Is the New Deepfreeze Refrigeration Principle?

100% primary freezing surface is provided in the Deepfreeze machine, which has been designed with a double-wall chilling cylinder, through which a refrigerant circulates. It is possible to reach temperatures as low as −120° F. with the Deepfreeze machine, which has the capacity to remove 1,000 B.T.U.'s per hour, at −120° F., when the work is immersed in a convection fluid

How Does the Deepfreeze Process Compare With the Dry Ice Method?

Dry ice temperature of −109° F. delivers a maximum chill of only −91° F. working efficiency, as compared with a constant 24 hour temperature of −120° F. provided by Deepfreeze. The cost for removing 1,000 B.T.U.'s per hour for a 24-hour day, over the period of one year, with dry ice is approximately $3,000; the current consumption of the Deepfreeze machine over the same period of time costs $175.

What Is the Cost of Deepfreeze?

The initial cost of only $2,500 for the standard Cascade −120° F. Industrial Chilling Machine is quickly recovered in reduced production costs. One manufacturer saved from $3,000 to $4,000 per month in shrink-fit application. Gage manufacturers save time and money by seasoning gages to prevent change in finished size. The increased tool life resulting from cold treating reduces down-time and lowers tool cost.

Is the Deepfreeze Process Still in the Experimental Stage?

No! Hundreds of Deepfreeze Industrial Chilling Machines are now being used in actual production. Deepfreeze equipment has been tested and proven highly valuable in such firms as The General Electric Company, Timken-Detroit Axle Company, Dodge Motors, Pratt and Whitney Division, Monsanto Chemical Company, Greenfield Tap and Die Corporation.

How Are Deepfreeze Sub-Zero Temperatures Being Used?

The possibilities for applying Deepfreeze Industrial Chilling Machines in your plant are practically unlimited. Here are but a few of the many applications finding widespread use in industry today.

- Treating of high speed steel cutting tools.
- Shrinking of metal.
- Shrink-fit assembly.
- Stabilization of gages.
- Hardening of precision machine parts.
- Testing of aircraft instruments and materials.
- Testing of lubricants, paints, plastics, chemicals, synthetic rubber and pharmaceuticals.

How Can Sub-Zero Temperatures Be Adapted to My Work?

If, after checking Deepfreeze uses listed above, you are not sure how sub-zero temperatures can be beneficially applied to your manufacturing, let Deepfreeze engineers work with you in finding the solution to your industrial metal chilling problems. The Deepfreeze Industrial representative in your territory will be glad to assist you in handling sample parts for a Deepfreeze test in the factory laboratory. There is no obligation.

What About Delivery?

If you can qualify, under government priority regulations, you can expect prompt delivery on Deepfreeze standard chilling machines.

WHERE CAN I GET MORE INFORMATION?

The complete and latest data on the use of sub-zero temperatures for industrial use can be found in the new Deepfreeze Metal Chilling Data Book. A Deepfreeze representative will be glad to answer other questions you may have and can furnish you with any further information.

Deepfreeze

TRADE MARK DEEPFREEZE REGISTERED UNITED STATES PATENT OFFICE

trial Chilling Equipment for Shrinking, Testing, Hardening and Stabilizing Metals

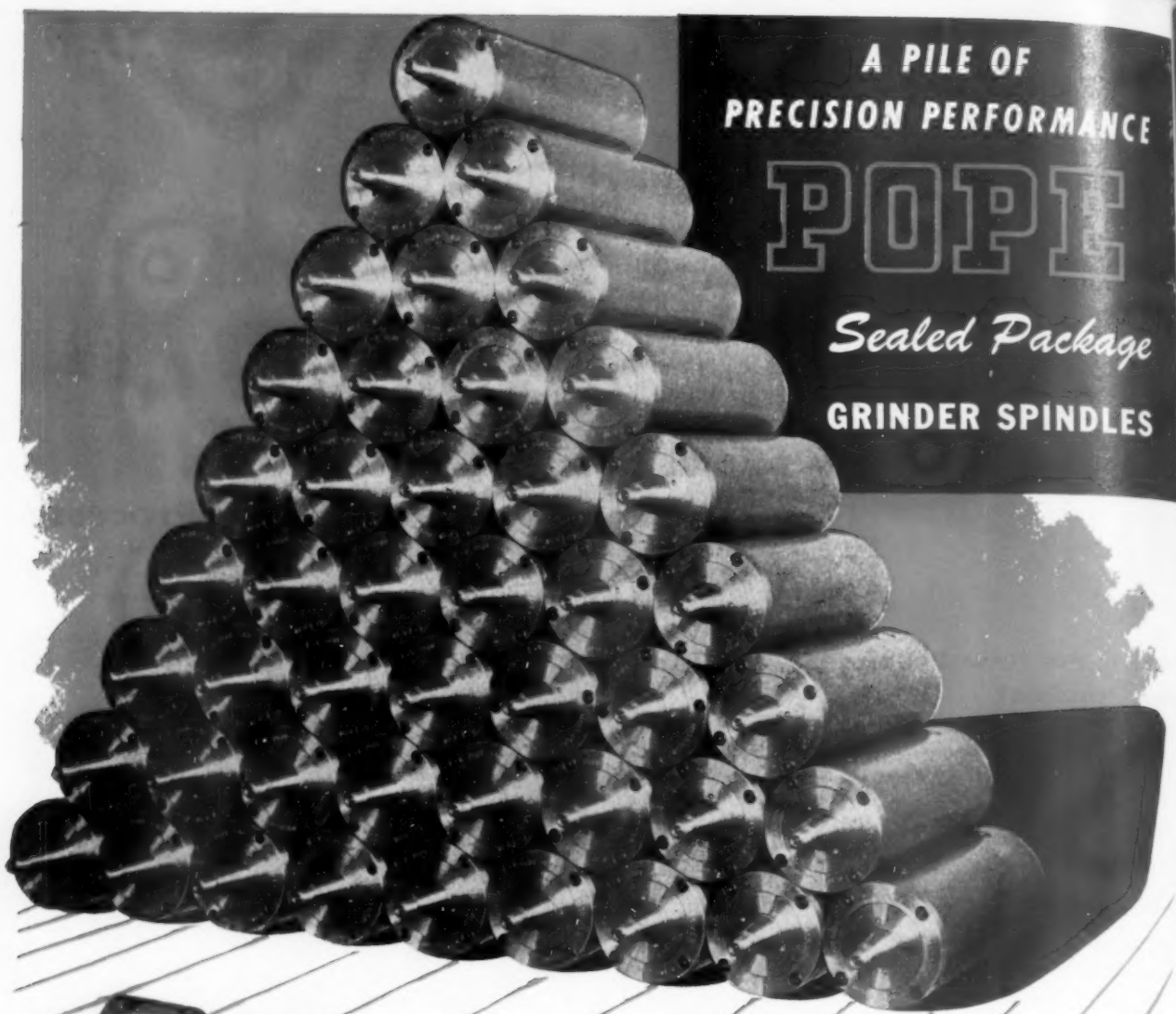
2311 DAVIS STREET
NORTH CHICAGO, ILLINOIS

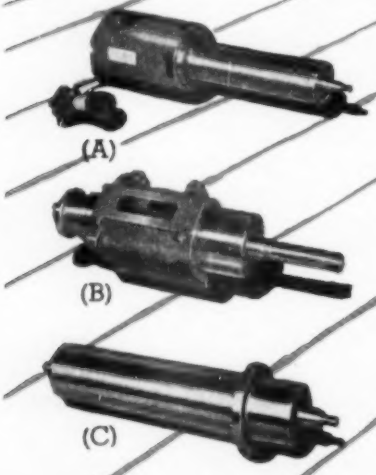
Division of Motor Products Corporation, Detroit, Michigan

A PILE OF PRECISION PERFORMANCE

POPE

Sealed Package GRINDER SPINDLES





There are many thousands of hours of precision grinding wrapped up in these POPE *sealed lubrication* Spindles that *require no attention*.

This pile of tool and cutter grinder spindles emphasizes the fact that each POPE Spindle is a complete, self-contained package in itself — ready to slip into the grinder and go to work without oiling, greasing, warming up or attention of any kind. The lubricant is *sealed* in — dirt *sealed* out.

Finely finished surfaces are assured when you put POPE Precision Spindles on the job. At left is (A) a surface grinder spindle with totally enclosed fan cooled motor, (B) a special high speed spindle with housing, used for winding glass thread, (C) a cartridge type sealed lubrication spindle used in 6" x 36" cylindrical grinders.

Write for Bulletin E describing and picturing a variety of POPE Spindles.

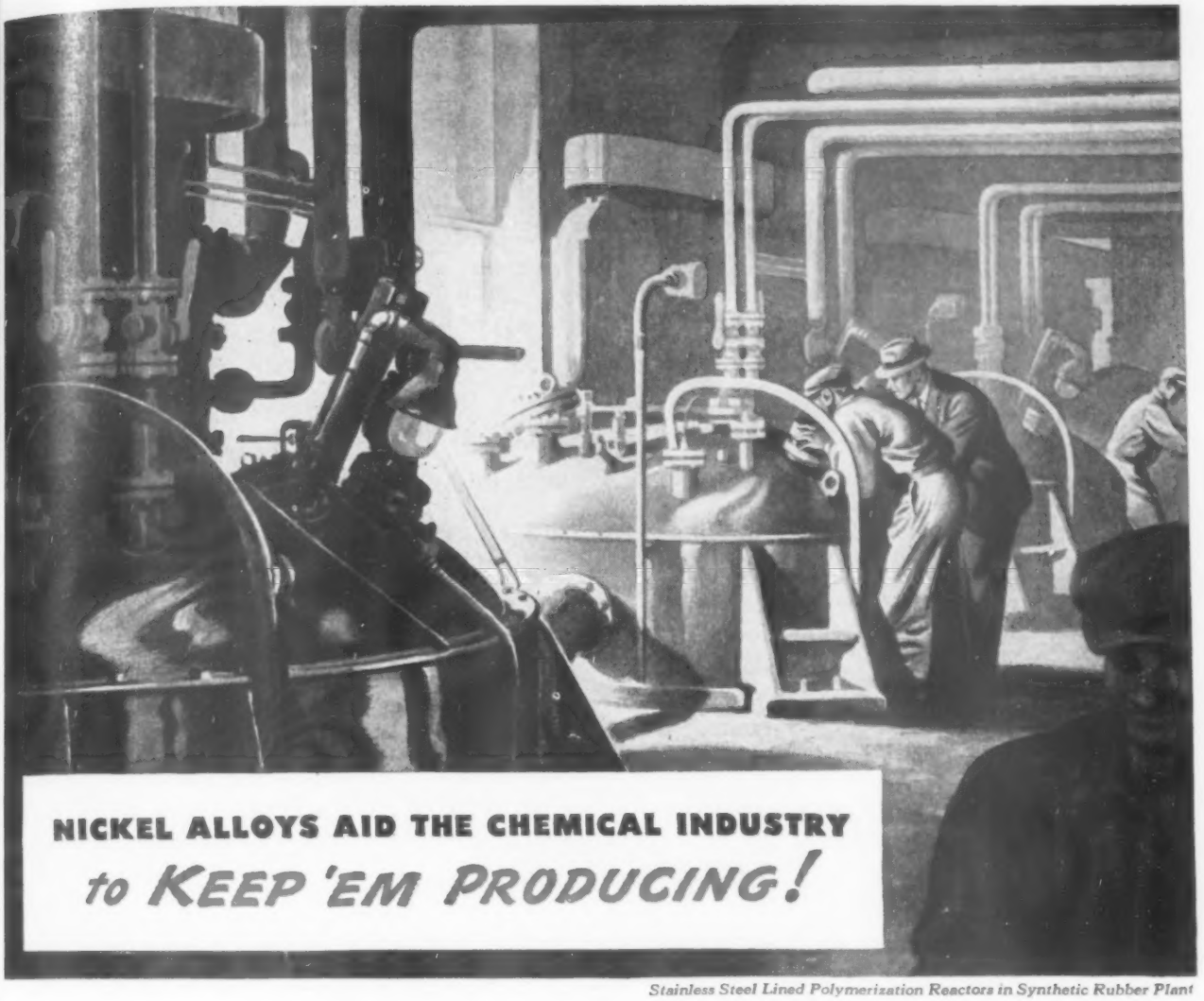
REG. U. S. PAT. OFF.

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES



NICKEL ALLOYS AID THE CHEMICAL INDUSTRY

to KEEP 'EM PRODUCING!

Stainless Steel Lined Polymerization Reactors in Synthetic Rubber Plant

Equipment of Stainless Steel, Nickel and Monel meets many specialized requirements

Chemical engineers have met America's wartime challenge.

They opened the gates to a mighty flood of products going to war...strategic raw materials, synthetic substitutes, and entirely new substances having advantages all their own.

A factor in this production success is the wide use of stainless steel, Monel, and other corrosion-resistant alloys containing Nickel.

For in the chemical industry corrosion is a large-scale menace.

To wage war on this enemy, chemical engineers enlisted the aid of Nickel, because Nickel imparts to other metals strength and resistance to corrosion and wear. In the chemical field, as in many others, a little Nickel goes a long way to keep equipment producing.

It prolongs the life of processing apparatus, and protects the purity, color, and uniformity of the product.

Hence, stainless and Nickel alloys are specified widely for acid heaters and caustic coolers, for high-pressure autoclaves and vacuum evaporators, for cracking towers and polymerization reactors, for shipping drums and tank cars, for pumps, piping and storage tanks, for agitators and settlers, for stills and digestors—for every type of equipment that converts laboratory experiments into full-scale chemical operations.

For years we have enjoyed the privilege of cooperating with technical men of the chemical industry...and of many others. Whatever your industry may be ...if you want help in the selection, fabrication, and heat treatment of alloys . . . we offer you counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

★ Nickel ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

50 to 3000

Pounds Pressure from your Present Hydraulic Circuits

with a

RACINE

Hydraulic Pressure BOOSTER

FOR NEW OR OLD HYDRAULIC CIRCUITS

"Variable Volume" PUMPS
"Balanced-Piston" VALVES

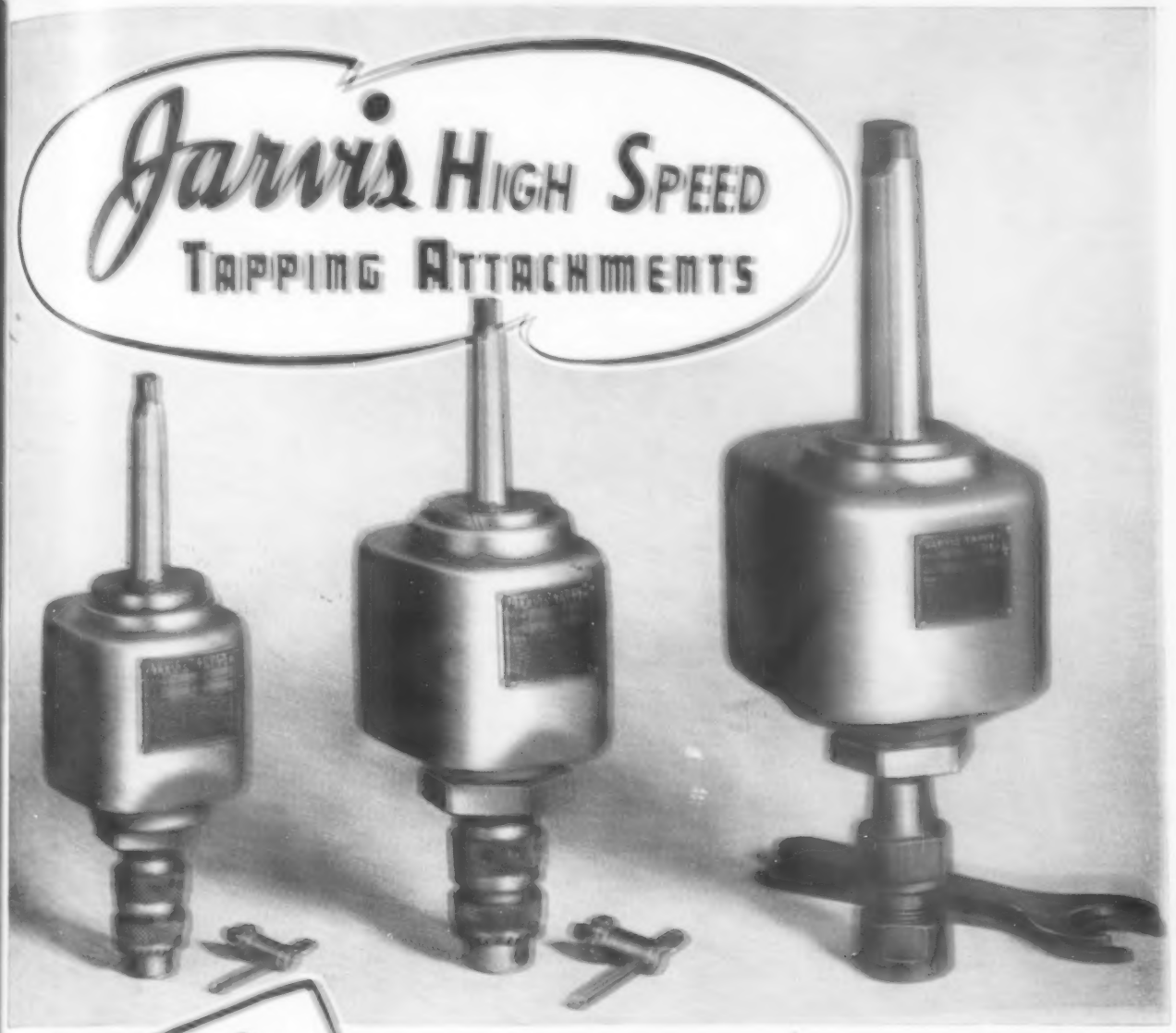
Racine "Variable Volume" Oil Hydraulic Pump

Racine Hydraulic Automatic Steel Feed Machine

RACINE METAL CUTTING MACHINES

RACINE TOOL and MACHINE COMPANY

Jarvis High Speed Tapping Attachments



Jarvis

TAPPING ATTACHMENTS
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FLEXIBLE SHAFT MACHINES
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GROUND ROTARY FILES
•
QUICK CHANGE CHUCKS AND COLLETS

They save Time and Taps

Jarvis Tapping Attachments for high speed production. Built for long, dependable service. Famous for long tap life and extreme accuracy. Save time and taps with Jarvis High Speed Tappers.

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THE CHARLES L. JARVIS COMPANY
MIDDLETOWN, - CONN.

50 to 3000

Pounds Pressure from your Present Hydraulic Circuits

with a

RACINE

Hydraulic Pressure BOOSTER

A high pressure, oil hydraulically actuated, compact, self-contained auxiliary to your present low pressure hydraulic circuit. Increases your source of force as much as 7 to 1. Creates new standards of flexibility and operating economy.

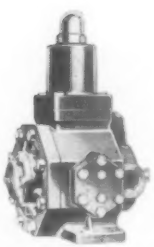
FOR NEW OR OLD HYDRAULIC CIRCUITS. Fits anywhere into your present or new hydraulic circuits without interference. Now you can obtain *high pressure when you need it—return to low pressure at will.* Use low horsepower motor and low pressure control valves—results in lower initial investment and reduced operating and maintenance costs.

Can be used in circuits with either variable or constant volume pumps.

Free from repairs — no gears to wear out — no driving mechanism to get out of adjustment. The Racine Hydraulic Pressure Booster is an exclusive patented unit. For complete information ask for illustrated bulletin. Address Dept. TE-P.

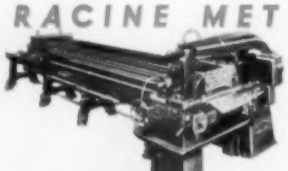
"Variable Volume" PUMPS "Balanced-Piston" VALVES

Include in your hydraulic circuits Racine Oil Hydraulic "Vane Type-Variable Volume" Pumps. Capacities 12 - 20 - 30 G.P.M. Operating pressures 50 to 1,000 pounds per square inch. Racine "Balanced-Piston" Valves insure ease of operation. Sizes ⅜" to 1½". Available with manual, solenoid, pilot and mechanically operated devices. Let Racine engineers help you with your oil hydraulic applications. Ask for Bulletin P-10-C.



Racine "Variable Volume" Oil Hydraulic Pump

RACINE METAL CUTTING MACHINES



Racine Hydraulic Automatic Stock Feed Machine

For 36 years Racine has led the field in metal cutting machines. Positive screw feed and the application of hydraulic operation, feed and control to metal cutting machines of the reciprocating type, were first developed by Racine. A full line—capacities 6" x 6" to 20" x 20".

RACINE
TOOL and MACHINE COMPANY
Standard for Quality and Precision
RACINE, WISCONSIN, U. S. A.

Jarvis High Speed Tapping Attachments

Jarvis

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FLEXIBLE SHAFT MACHINES
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THE CHARLES L. JARVIS COMPANY
MIDDLETOWN, • CONN.

For successful steel milling with carbides

- USE NEGATIVE RAKE
- INCORPORATE HEAVY BODY DESIGNS
- FINISH-GRIND EDGES WITH

DI-MET DIAMOND WHEELS

CUTTER engineers and carbide manufacturers are constantly improving carbide milling cutter designs for milling of steel and other metals. All approve of finish-grinding carbides with diamond wheels to obtain the finest, sharpest cutting edges! It's important—because diamond finished edges are smoother—make for longer cutter life, better surface finishes, lower power consumption—save wear and tear on both cutters and machines and cut much faster than ordinary abrasives.

DI-MET resinoid bonded diamond wheels are made in diamond grit sizes and concentrations for all carbide grinding applications and in types for reaching intricate shapes on cutting tools, for cylindrical grinding or plunge cutting on dies, and wherever carbides are used. They're fast, long lived, economical. Types, sizes, specifications and prices of DI-MET wheels are covered in our new catalog. Write for your free copy.

FELKER DI-MET

FELKER MANUFACTURING CO.
1121 BORDER AVE., TORRANCE, CALIF.

MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

GORTON

SPECIALISTS FOR OVER 50 YEARS IN

Tracer-Controlled MILLING

Automatic *Rotation PROFILING

*WORK and MASTER **ROTATE** with TABLE MOVEMENT

CYLINDRICAL Interrupter Cam for Gun-Fire Control

A Typical HIGH PRODUCTION Profiling Job—done on the Gorton 9-J Duplicator. 10 elliptical wells—no two the same size—on each of these cylindrical work pieces are rough and finish milled, with beveled edges—simply by combination of Tracer Control, with Automatic Rotation of work and master, geared to table movement—all controlled by one central lever motion.

Blank cylinders come to the Gorton Duplicator, finish-turned. The 10 wells are first rough milled to a depth of .052". Then a finish cut, with the same cutter and spindle speed, removes .010" stock, merely by lowering spindle the required amount. Hand finishing required is almost negligible—due to the excellent finish obtained by the use of 2-flute Tungsten Carbide form cutters—at Gorton high spindle speeds.

PRODUCTION DATA

Material—S.A.E. 1020 Seamless Steel Tubing.
Operation—Rough and Finish Milling of 10 Wells (varying from 3/4" wide x 3/8" long . . . to 35/8" wide x 2" long), .062" deep.
Cylinders—99/16" O.D. x 725/32" long.
Feed—Manual . . . Spindle Speed—4,000 r.p.m.
Tolerances—±.005".
Time—Roughing 18 minutes; finishing 23 minutes; total floor-to-floor, 43 minutes. (10 wells complete, average 4.3 min. per well.)

ENGINEERING SERVICE . . . FREE

Have the advantage of 50 years of Gorton Specialized Tracer Control Experience in your shop—call nearest Gorton dealer or write to Gorton factory at Racine, Wisconsin.

The *Right* Size The *Right* Type of Machine for Every Job . .

From 2 oz. to 2 ton

DIE BLOCKS

Tracer-Controlled MILLING

Tracer-Controlled DUPLICATING

Tracer-Controlled ENGRAVING

Tracer-Controlled ETCHING

GORTON Precision MACHINES

CUTTER GRINDERS
ETCHING MACHINES
2 & 3 Dimensional PANTOGRAPHS
Vertical & Universal Head Super-Speed MILLERS
Manual & Electric Control DUPLICATORS

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George Gorton Machine Co.,
1105-13 Racine St., Racine, Wis.
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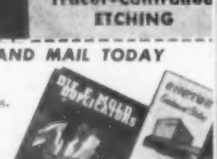
- ☐ Die and Mold Duplicators



Name..... Title.....

Company.....

Address.....

City..... State.....

During the past five years, one set of progressive operation dies made of Graph-Mo Steel produced 6,000,000 clutch housings for automobile window regulators.

Even with this impressive record, these dies are continuing to provide trouble-free performance and to produce perfect, scratch-free parts that are accurate to .002".

This kind of proven performance is responsible for the steadily increasing popularity of Graph-Mo and the other Graphitic Steels, Graph-Tung, Graph-Sil, Graph-Al and Graph-M.N.S.

Include these five steels in your Post War plans. They will increase production and cut costs because they wear longer, they machine at least 25% faster than competing steels and they have less tendency to score work.

One of our metallurgical engineers will be glad to recommend the proper Graphitic Steel for any specific application you have in mind. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

EX-CELL-O CYLINDER BORING MACHINE

To left: Ex-Cell-O angular type machine equipped with six spindles to finish bore valve seats and valve guide holes in cylinder head of aircraft engine on a production basis. Each spindle is individually adjustable for depth of cut, as are the tools in the boring bars (boring bars, not shown in picture, are piloted in the fixture).

SPECIAL MACHINES

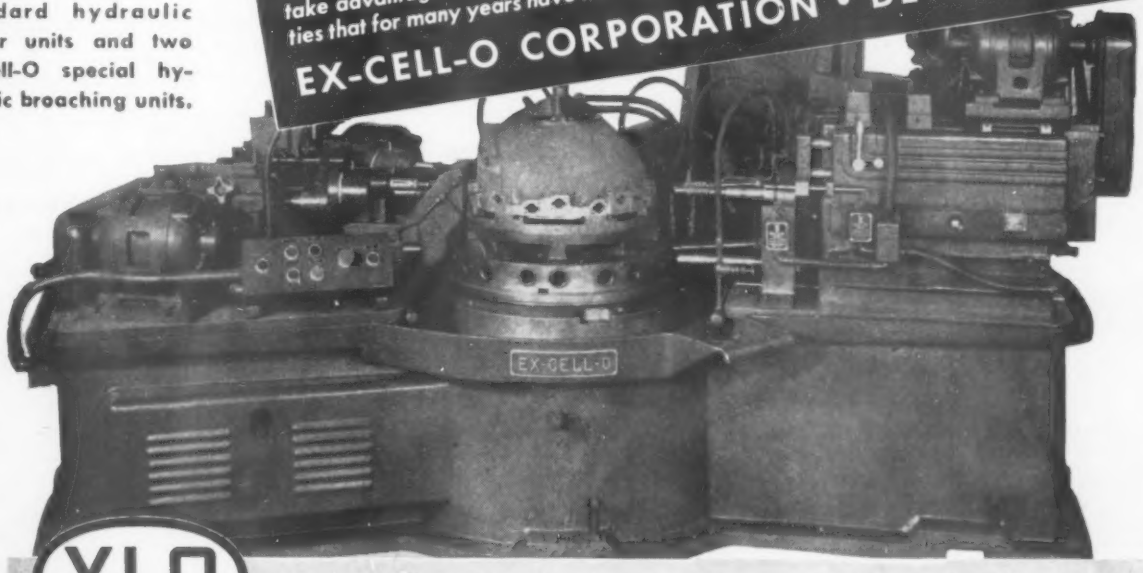
...for today's production...and tomorrow's

For years Ex-Cell-O has been familiarly known as "the headquarters" for special single-purpose machines for turning out accurate parts at a high rate of speed . . . machines that frequently perform numerous operations in one setting of the work and often bring not only a substantial increase in the number of parts produced hourly but also improved quality and reduced unit cost. . . . This is why so many manufacturers have turned to Ex-Cell-O for equipment to meet their war production schedules; why Ex-Cell-O designed machines will figure in the post-war plans of an increasing number of American industries. . . . If you are planning for tomorrow, when the new standards will necessitate costs that are competitive, take advantage of the wide engineering experience and extensive manufacturing facilities that for many years have made Ex-Cell-O a leader in the precision machine tool field.

EX-CELL-O CORPORATION • DETROIT, MICH.

EX-CELL-O SIX-WAY MACHINE

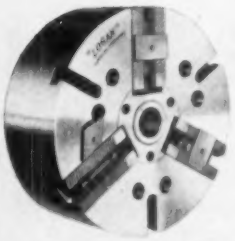
Below: Ex-Cell-O six-way machine for drilling, broaching and reaming valve guide holes in a magnesium crankcase. This machine it equipped with four standard hydraulic power units and two Ex-Cell-O special hydraulic broaching units.



XLO

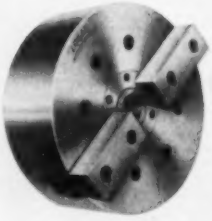
EX-CELL-O *for* PRECISION

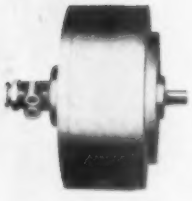
Precision THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT PURE-PAK CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS



American Standard
3-Jaw
Air or Hydraulically
Operated Chucks

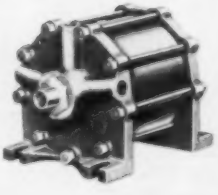
American Standard
2-Jaw
Air or Hydraulically
Operated Chucks

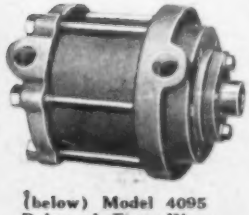




(left) Model "R"
Double Acting
Rotating Type
Air Cylinder

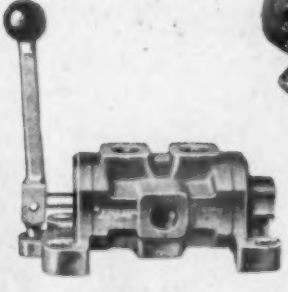
(right) Model "B"
Double Acting
Non-Rotating Type
Air Cylinder



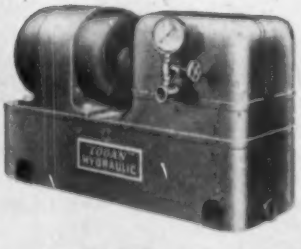


(left) Model "HA"
Double Acting
Non-Rotating Type
Hydraulic Cylinder

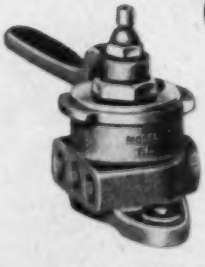
(below) Model 4095
Balanced Four Way
Piston Type
Hydraulic
Control Valve



(above)
Model "MC"
Heavy Duty
Mill Type
Air Cylinder



Model 6036
Hydraulic
Power Unit



Model "TL"
Plug Type
Air Control Valve

Model 6245
Master Control
Valve for Remote
Air Operating
Systems

Model 6520
Foot Operated
Air Control Valve

Model 6000
Standard
Hydraulic Press

For Future Production Needs

MODERNIZE WITH

"LOGAN"

AIR AND HYDRAULIC EQUIPMENT

Future production will demand machines that produce more and better products with fewer man hours and machine hours. "LOGAN" is ready NOW to help you solve these problems with a complete line of Air and Hydraulic Equipment. Easily adaptable to all types of production machines, thousands of uses have been found for "LOGAN" equipment in the world's leading industrial plants. Let "LOGAN" Engineers make recommendations on modernizing your plant by the application of "LOGAN" Equipment.

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A MODEL FOR EVERY JOB...

JONES & LAMSON Optical Comparators are made in various models designed to cover an almost unlimited range of inspection work—from precision products of the tool room through a diversity of industrial parts and products requiring a method of inspection that is at the same time accurate and rapid.

The design of these models is the outcome of more than twenty years experience in the field of inspection by optical projection.

Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

This book, "Beyond a Shadow of a Doubt" will tell you more about our Optical Comparators and what they are doing.

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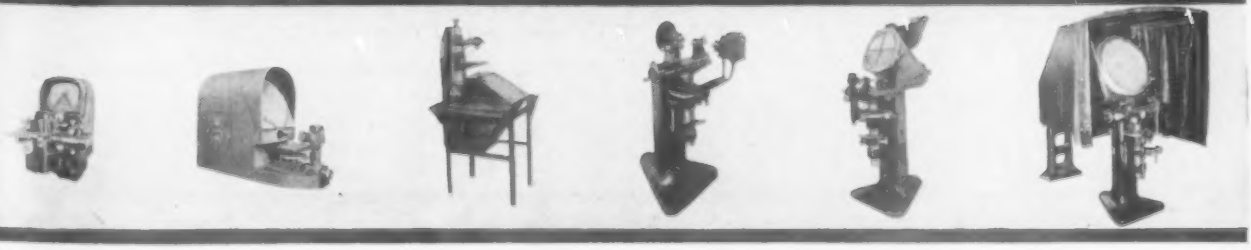
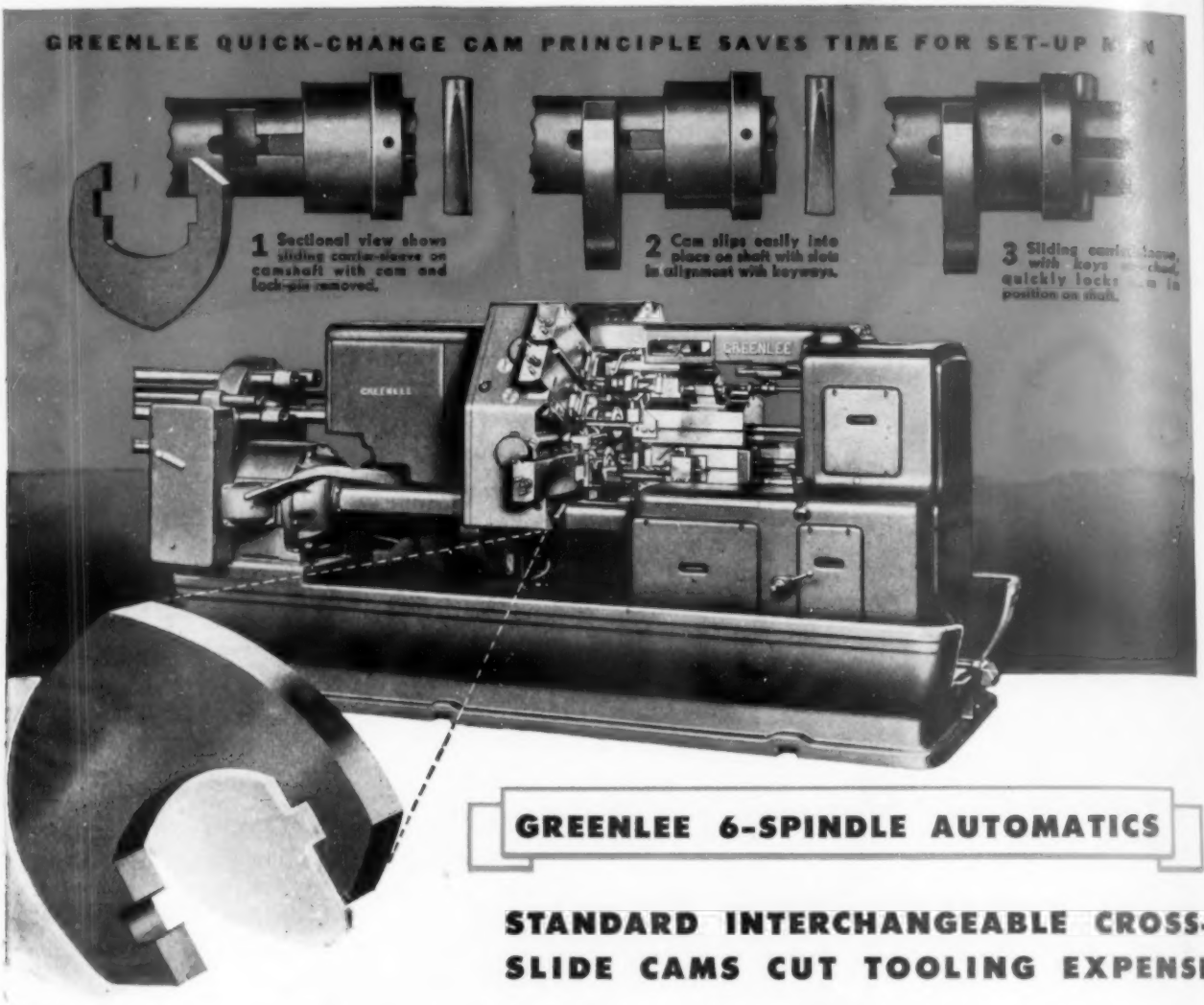
Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers




GREENLEE QUICK-CHANGE CAM PRINCIPLE SAVES TIME FOR SET-UP MEN
1 Sectional view shows sliding carrier-sleeve on camshaft with cam and lock-pin removed.
2 Cam slips easily into place on shaft with slots in alignment with keyways.
3 Sliding carrier-sleeve, with keys inserted, quickly locks cam in position on shaft.
GREENLEE

GREENLEE 6-SPINDLE AUTOMATICS

STANDARD INTERCHANGEABLE CROSS-SLIDE CAMS CUT TOOLING EXPENSE

Simplicity of design makes it possible, today, to operate Greenlee Automatics effectively on more than just the ordinary "cut-and-dried" multiple-spindle screw machine jobs. The cross-slide cam feature on the Greenlee, *for example,* promotes production efficiency on many short-run jobs by reducing set-up time and through savings in tooling expense.

As shown in top photos, individual cams (only one used for each independently operated cross-slide) are quick and easy to slip on or off. All cams are completely interchangeable and may be used on any cross-slide. Thus, only a very few are required — see details at left.

There are other *time-saving, cost-saving* Greenlee features, too, that offer production advantages in building weapons of war or products of peace. Ask for latest details. Perhaps Greenlee engineers can help you tie in war demands, today, with your peace conversion plans. *Write* —

GREENLEE BROS. & CO., 1945 MASON AVE., ROCKFORD, ILL.

SMALL CAM INVESTMENT HANDLES 90% OF AVERAGE JOB-SHOP REQUIREMENTS

With a Greenlee 6, a job-shop can handle 90% of average requirements with but fifteen *standard* cross-slide cams which provide a wide variety of feeds and strokes. *Seldom are special cams required.* An exclusive Greenlee feature eliminates the use of cams on main tool slide.

The following list of cams are all that are usually needed for one machine to serve a wide range of requirements:

Quantity	*Cam Ratios
2	2:1
3	3:1
3	4:1
2	5:1
3	6:1
1	8:1
1	Cut-Off

TOTAL INVESTMENT... ONLY $131.35

*Standard cams are made in ratios to tool-slide feed and stroke. For example, 2:1 Cam = ½ feed of tool-slide and ½ stroke. Feed = feed per revolution.

GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

WITH WHEELS BY CARBORUNDUM, PRODUCTION AND PRECISION GO HAND IN HAND

THERE is everything to be said about having exactly the right wheel on any kind of a cylindrical grinding job—and on every grinding job!

This is an all important factor in getting higher production and greater precision.

Proper wheel selection also reduces grinding time, lowers wheel and grinding costs, makes certain of getting a desired finish.

Carborundum abrasive engineering service certainly can be of decided help in getting these results—in your getting the best and the most out of your grinding wheels. This service we feel can be of great value to you. We suggest you take advantage of it.

Incidentally, we have quite a library of helpful booklets on Tool Room Grinding. Roll Grinding, The Grinding of Cemented Carbides, Common Grinding Faults and Their Correction, etc. Copies sent on request. The Carborundum Company, Niagara Falls, New York.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

Grinding Wheels by **CARBORUNDUM**

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Macklin Wheels
will grind your welds
fast and efficiently.

MACKLIN HIGH QUALITY WHEELS
FOR EVERY GRINDING PURPOSE WILL
"PROTECT YOUR PRODUCTION"

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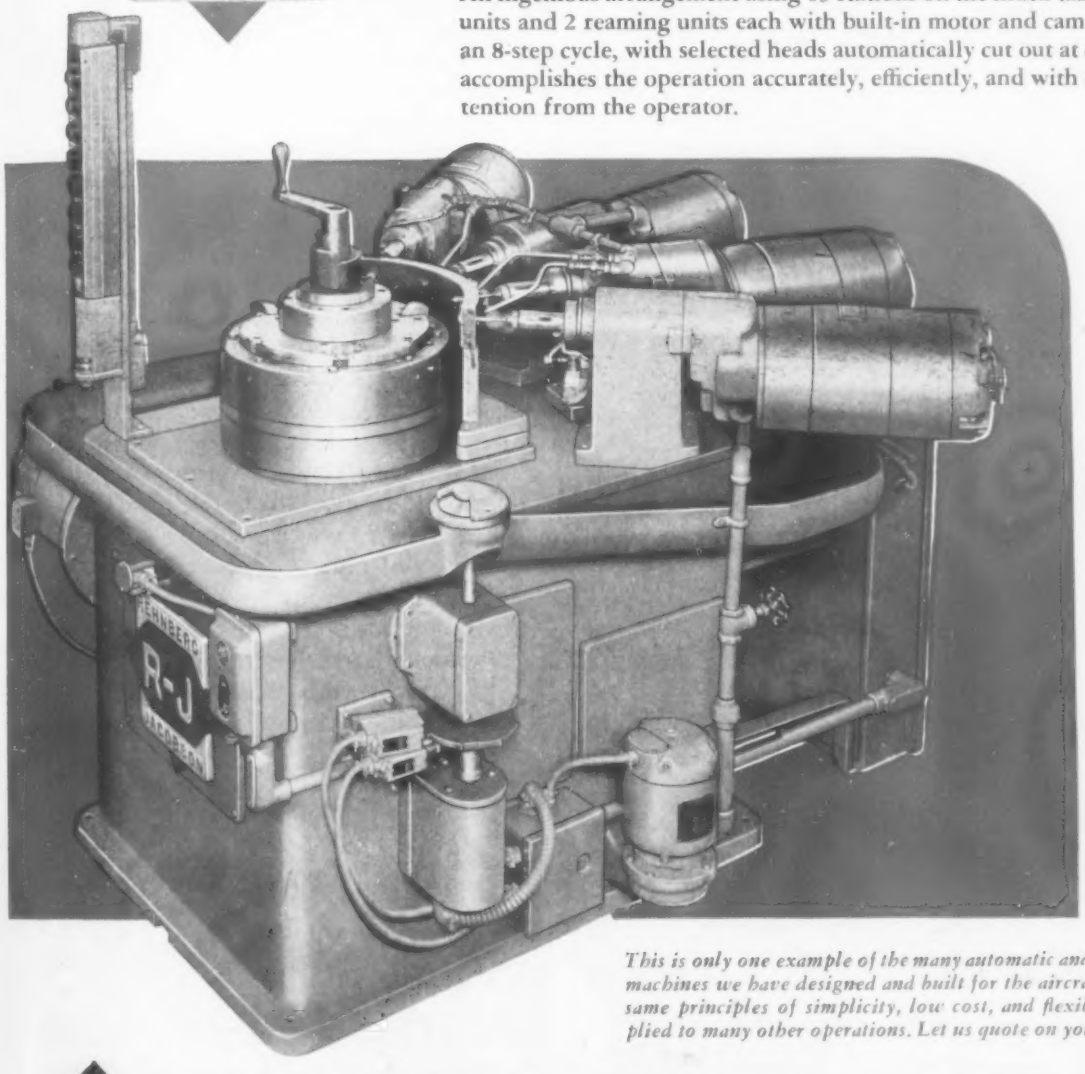
Rehnberg-Jacobson

SPECIAL *Aircraft* PRODUCTION MACHINE

This machine is designed for automatically drilling and reaming a series of 13 equally-spaced radial holes .218" dia. in the body of a stationary reduction gear used on an aircraft engine. It consists of four No. 2 Rehnberg Drill Units and a 13-station Automatic Index Unit, with a program wheel controlling all steps in the completion of the cycle. The operator simply clamps a gear in position, starts the machine and, when the cycle is finished, removes the completed piece.

DRILLS *and* REAMS 13 HOLES

An ingenious arrangement using 13 stations on the index table, 2 drilling units and 2 reaming units each with built-in motor and cam control, and an 8-step cycle, with selected heads automatically cut out at certain steps, accomplishes the operation accurately, efficiently, and with minimum attention from the operator.



This is only one example of the many automatic and semi-automatic machines we have designed and built for the aircraft industry. The same principles of simplicity, low cost, and flexibility can be applied to many other operations. Let us quote on your requirements.

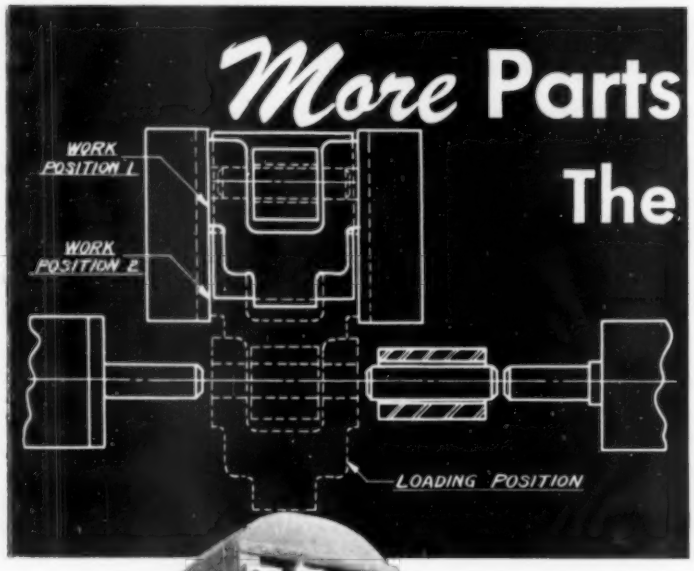
REHNBERG R-J JACOBSON

REHNBERG-JACOBSON MANUFACTURING CO.

Special Machinery

2137 KISHWAUKEE ST. ROCKFORD, ILLINOIS

More Parts Per Broach The *American* Way—



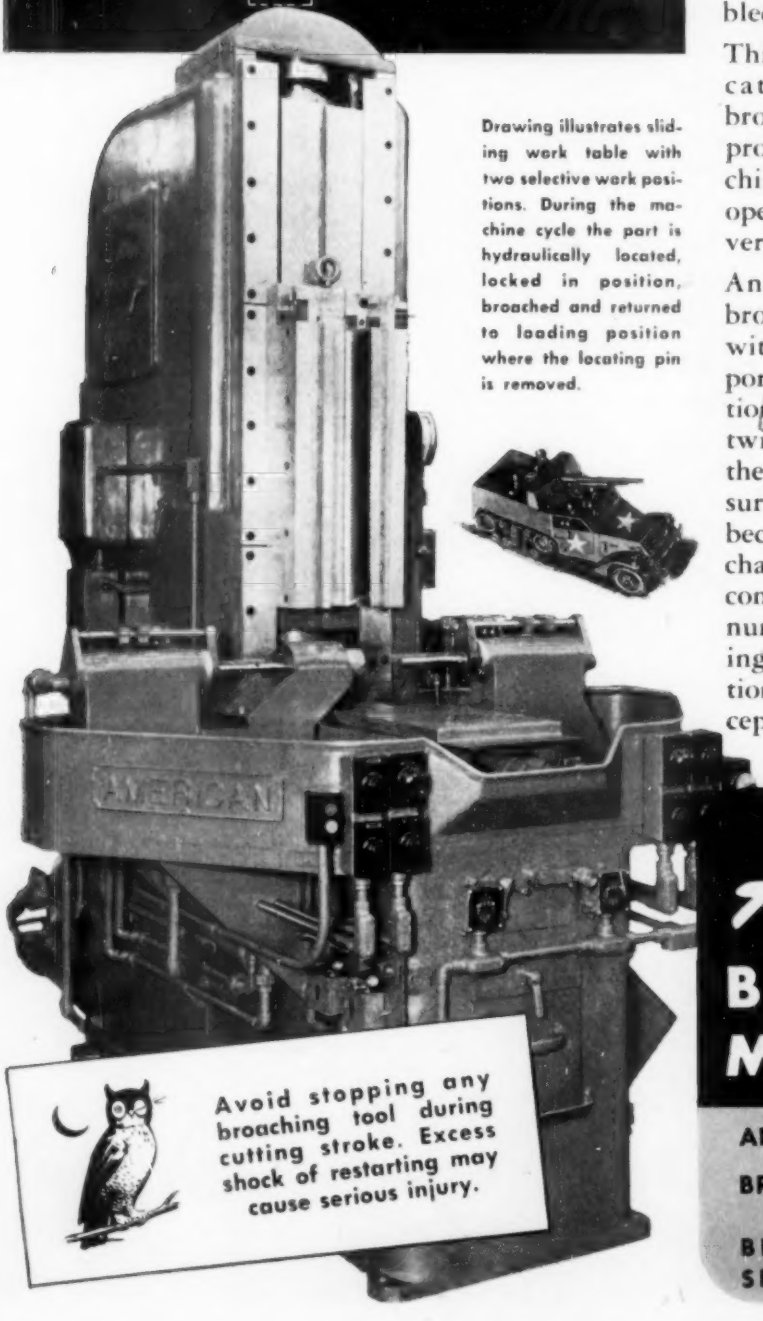
PROVEN in war... Ready for PEACE

Precision work at a mass production rate—*plus* the extra economy of doubled output per broach sharpening!

This is a typical example of the application of *American's* complete broaching service to a production problem. American Broach & Machine Company engineers set up this operation to finish the sides of universal joint yokes.

An American SB-42-10 surface broaching machine is used, equipped with a special receding table incorporating two selective work positions. Extra wide broaches, more than twice the part width, make possible the use of one half of the broaching surface at a time. When this half becomes dull the position may be changed so that the remaining half continues the operation. Twice the number of parts per broach sharpening are obtained, reducing production cost and time, maintaining exceptional finish and accuracy!

Drawing illustrates sliding work table with two selective work positions. During the machine cycle the part is hydraulically located, locked in position, broached and returned to loading position where the locating pin is removed.



Avoid stopping any broaching tool during cutting stroke. Excess shock of restarting may cause serious injury.

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

DoALL Cuts Solid Steel Cylinder "Like a Loaf of Bread"

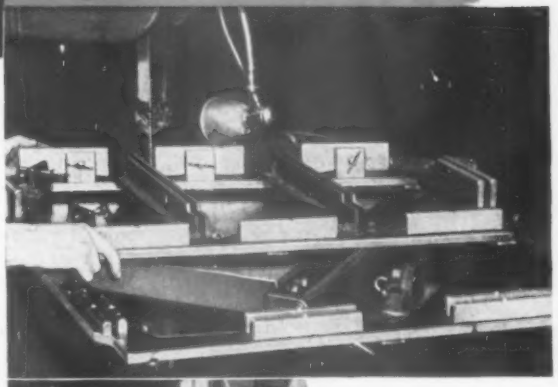
That's what this operator at a large Aviation Plant says, and he ought to know, because for the past three years he has been doing all kinds of time-saving DoALL contour and straight cutting, a few examples of which are shown here.

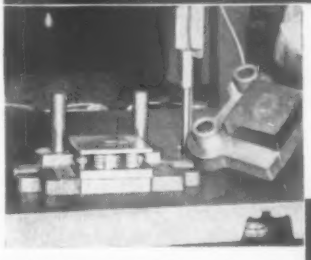
Soon Pays for Itself

The DoALL Contour Machine is such a versatile tool that its cost is quickly paid by speeding up all kinds of internal and external sawing, saving thousands of valuable man hours. Cuts, files and finishes any metal, alloy, plastic, plymetal, wood or laminated material.

Indispensable in tool room, machine shop or on regular production line. Six models, priced from $1,000 to $5,000 with motors.

CONTOUR SAWING BOOK — 265 pages of short cuts to better machining, and other helpful data. Send for copy.

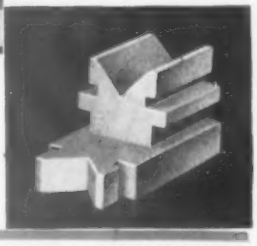




Jig for building plane doors made from steel cut and filed on a DoALL.

Above—Precision Die for stamping fuel tank "patch".

Right—A fine job of angle cutting. V Block cut, filed and finished on a DoALL.



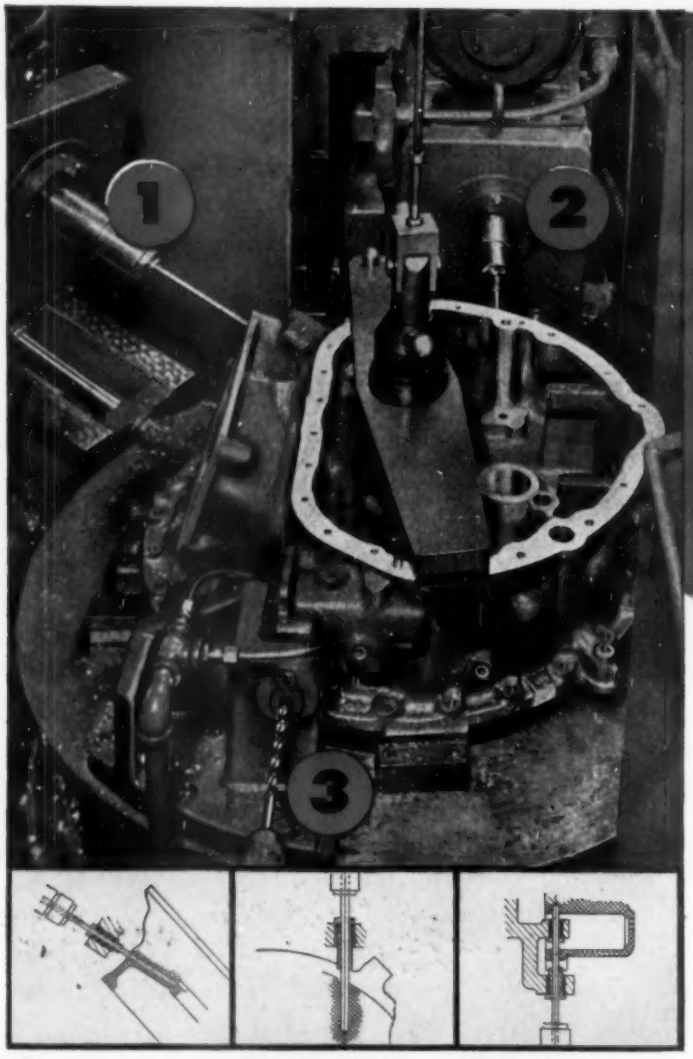
DoALL

INDUSTRY'S NEW SET OF TOOLS

CONTINENTAL MACHINES, INC.

1304 South Washington Avenue • Minneapolis 4, Minn.

Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Portland, Rochester, Rockford, St. Louis, Salt Lake City, San Francisco, Seattle, Spokane, Toledo, Tulsa, West Hartford.



1 Drill 5/16" hole 3-1/16" deep

2 Drill 27/64" hole 2-9/16" deep

3 Drill Through 2 walls with 21/64" drill

Miscellaneous Holes Drilled 8 Times Faster with W. F. & JOHN BARNES UNIT TYPE MACHINES

Drilling Time Reduced from 10.65 to 1.30 Minutes per Crankcase

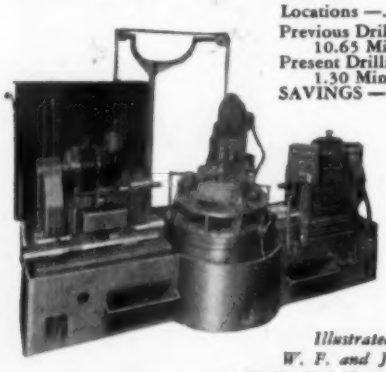
Doing the same job in one-eighth the former time ... that's the production rate set by a W. F. and John Barnes unit type 3-spindle three unit machine in the plant of this large aircraft engine manufacturer. Actual time saved per crankcase in performing this 3 hole drilling operation was 9.35 minutes. Two machines were formerly required to do the job. By being able to perform the same operations on a single unit type machine, valuable man hours are saved and floor space conserved.

TOOLING AND OPERATIONS

Unit 1 — 5/16" drill.
Unit 2 — 27/64" drill.
Unit 3 — 21/64" drill.

Units 1 and 2 — Provided with step-drilling attachment.
Units 1 and 2 provided with coolant manifolds (not shown) when rifle drilling these holes.

Diameters — .003" — .004".
Locations —. 010".
Previous Drilling Time — 10.65 Min.
Present Drilling Time — 1.30 Min.
SAVINGS — 9.35 Min.



Illustrated at the left is a W. F. and John Barnes 3-way 3-spindle Unit-Type Machine for machining airplane engine intermediate rear crankcase. Tooling for this job is illustrated above.

Unit Machines are Designed to Perform a Number of Operations

Performance stories of this kind are being continually submitted by users of W. F. and John Barnes unit type machines. Their versatility makes them highly adaptable to many types of machining operations. They are constructed from standard hydraulic feed and drive units which are easily rearranged to accommodate changes in part design. Where operations are required on a number of different parts quick-change heads can be provided. The general design of unit machines readily lends itself to a rapid conversion from war to peace-time production.

Submit Your Production Problems to our Engineers

The next time you are confronted with a production problem submit it to our engineers. They will make a complete analysis of it and suggest a machine to solve it. Their advice, based on years of experience in the design and construction of special machine tools, will result in greater production economy. This service is offered to you without cost or obligation.

FREE Useful Machining Information will be sent upon request.

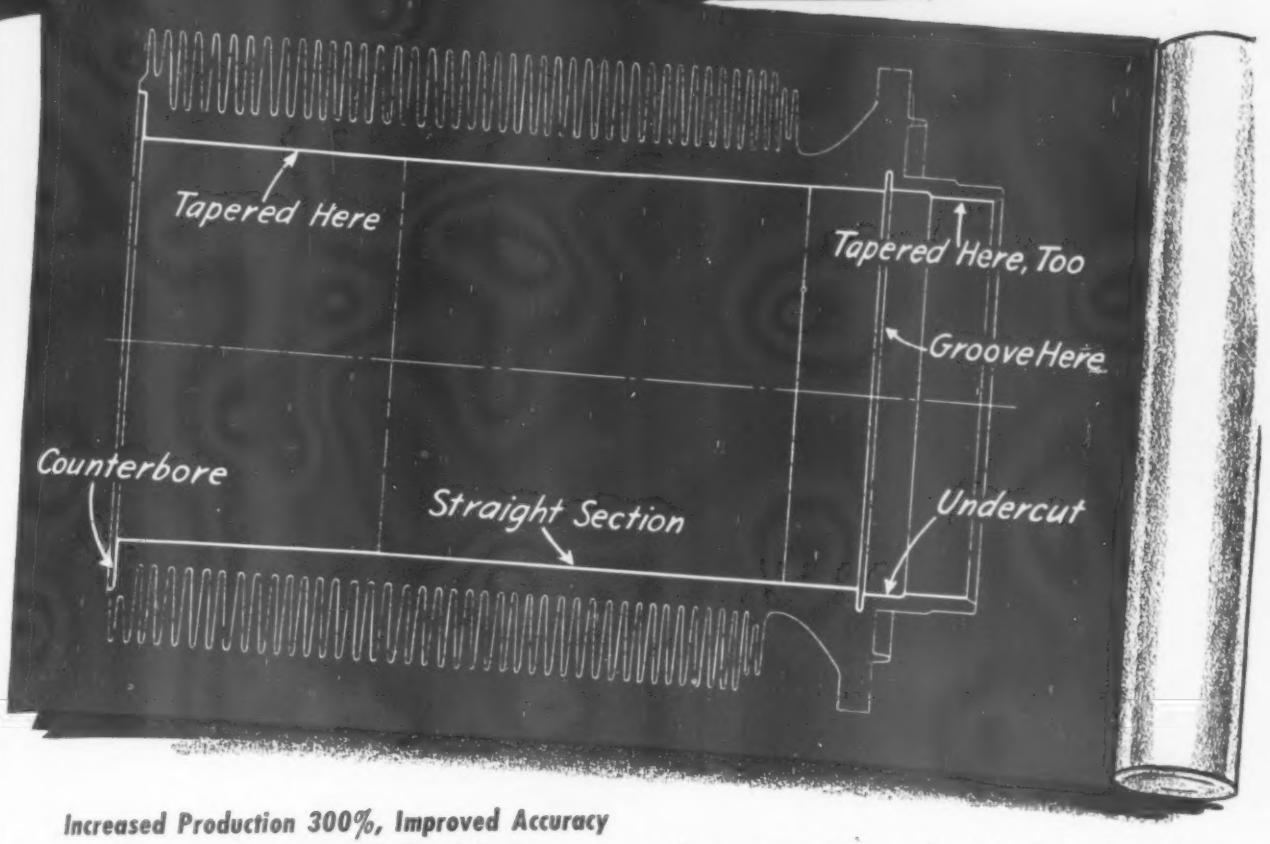
5 booklets on W. F. and John Barnes machines and their applications. Write for Bulletins Number 544A.

8 booklets showing typical tooling applications and problem solutions. Write for Bulletins Number 544B.

W. F. and JOHN BARNES

325 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

HOW A STUDY IN BLUE SAVED 13,000 MAN-HOURS



Increased Production 300%, Improved Accuracy and Finish, Greatly Reduced Scrap

SOMEWHAT OF A tricky part it was—this aircraft engine cylinder.

It took three machines and a whole series of different set-ups to turn it out—and even then it was not satisfactory. There was considerable scrap, low, low production and of course, costs that couldn't help but be too high.

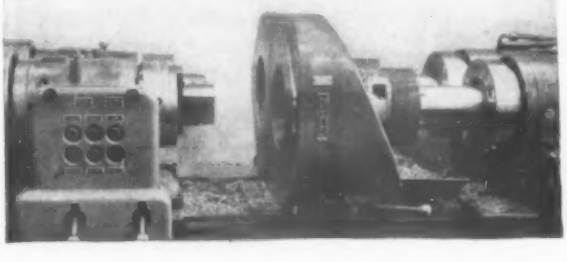
Then the engine builder came to Heald. And "thinking it out paid out"—once again.

Heald Precisioneers suggested doing the job this way... a single set-up . . . a single machine — the Heald No. 46B Double-end Bore-matic.

This versatile machine generates the tapers at both ends of the cylinder, machines the central straight section in one continuous cut, using specially designed cam-controlled tool slides to turn the trick. Grooves and recesses are then machined by hydraulic cross-feed units.

Result: A new conception of precision—greatly superior alignment, concentricity, squareness, finish and dimensional accuracy. Rejections . . . practically zero. Production . . . times three. Man-hours saved . . . 13,000.

Problems . . . now or post-war? Let us help you. The Heald Machine Company, Worcester 6, Massachusetts.



HEALD *for more Precision . . . Faster!*

Internal and Surface Grinding Machines • Bore-matic Precision Finishing Machines

WETMORE "Producers"

FOR HEAVY CUTS and HIGH PRODUCTION

• Wetmore Producers are specially designed for extra heavy roughing and finishing operations—to remove large amounts of stock faster and better. Like all Wetmore products they have features that offer definite advantages where the high production of precision holes is desirable.

The type 41 Wetmore Producer, shown above, is for roughing; type 61, its companion model, is a finishing tool. Wetmore builds modifications of them for special requirements.

When reamers and boring bars are needed on the job—Wetmore Tools are the natural answer. See your industrial distributor or write us direct.

The new Wetmore catalog contains complete tool specifications and details together with important data and information you will want. Write for your copy today. Free to executives and engineers.

WETMORE REAMER CO., 418 No. 27th St., Dept. C, Milwaukee 8, Wis.

Standard Coded Lubrication Service

. . . a definite answer to your oilers' question, "Which lubricant to use?"

The best lubricants and the most careful study of where and how to apply them are wasted unless the *right* lubricant is applied to the *right* spot every time it is needed. Worse than that, when lubricants are misapplied, machines may be damaged, time is wasted repairing them, and production drops off. The men in charge of your lubrication can tell you how troublesome this problem is in your plant—particularly today with new men on machines and oiler crews changing continually.

Misapplied lubricants have been as much of a problem to us as to you. For example, our Engineers may work with your plant men to determine the right lubricant for a certain troublesome application. It is found and works successfully for some time. Then trouble suddenly occurs—bearings go out, and a machine is tied up. Perhaps a new oiler was on the job—his instructions might not have been clear—or someone just "forgot" and the wrong lubricant was applied. But before the real cause is discovered—if it ever is—our lubricant is subjected to criticism and you waste time needlessly trying to find another.

Standard Coded Lubrication Service is our contribution towards solving your problem and ours.

The plan is briefly described at the right. Any plant is free to use this system or adapt it to its lubrication program. Plants in the Middle West, whether they use Standard Oil products exclusively or not, can get the materials needed, and the help of a Standard Lubrication Engineer in installing the service. Call the nearest Standard Oil Company (Indiana) office. Say you want to get more information about Standard Coded Lubrication Service. Or write 910 S. Michigan Ave., Chicago 80, Ill. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

How Standard Coded Lubrication Service works

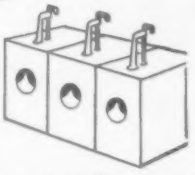
The first step in the plan is to assign code numbers to each lubricant used in the plant. Lubricants are simply numbered 1, 2, 3, etc. These numbers bear no significance as to type or grade of lubricant. Next, numbered decalcomanias (furnished by us) are applied to:

—every point of lubrication on every machine

—every grease gun or oil can used in servicing equipment

—every container or drum on your lubrication carts where they are used

and every barrel, drum, or storage tank in your oil house.



You can see at a glance that oilers merely need to follow the code number when filling dispensing equipment from storage, and in applying the lubricant to the right place, which is clearly marked to show that lubrication is needed and what number to use.

Machine Record Cards: Where desired, a supply of machine record cards is provided. The card or a copy of it may be kept in office files. This card shows the number of points to be lubricated, lubricants to be used, and lubricating schedules.

Lubrication Chart: For control purposes, a card is provided to list, by brand name and code numbers, all lubricants used in the plant. This card is used by stock clerk or stockkeeper to enable him to requisition products by brand name, and to mark barrels with the correct code numbered decal.

This Booklet gives full details of how Standard Coded Lubrication Service can go to work in your plant. Ask your Standard Oil Man for a copy. Talk it over with him and the men in charge of your lubrication. See how this plan fills a gap in your lubrication program.

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICAT

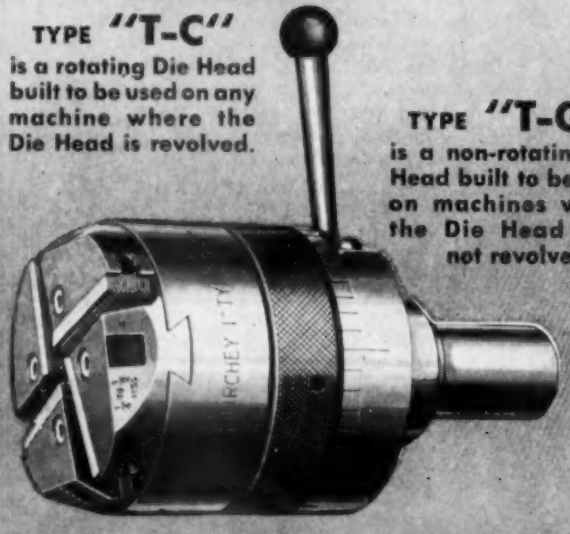
MURCHEY

Now Offers

NEW AND IMPROVED TANGENT CHASER SELF OPENING DIE HEADS!

..4 WEEKS DELIVERY..

TYPE "T-C"
is a rotating Die Head built to be used on any machine where the Die Head is revolved.



TYPE "T-G"
is a non-rotating Die Head built to be used on machines where the Die Head does not revolve.

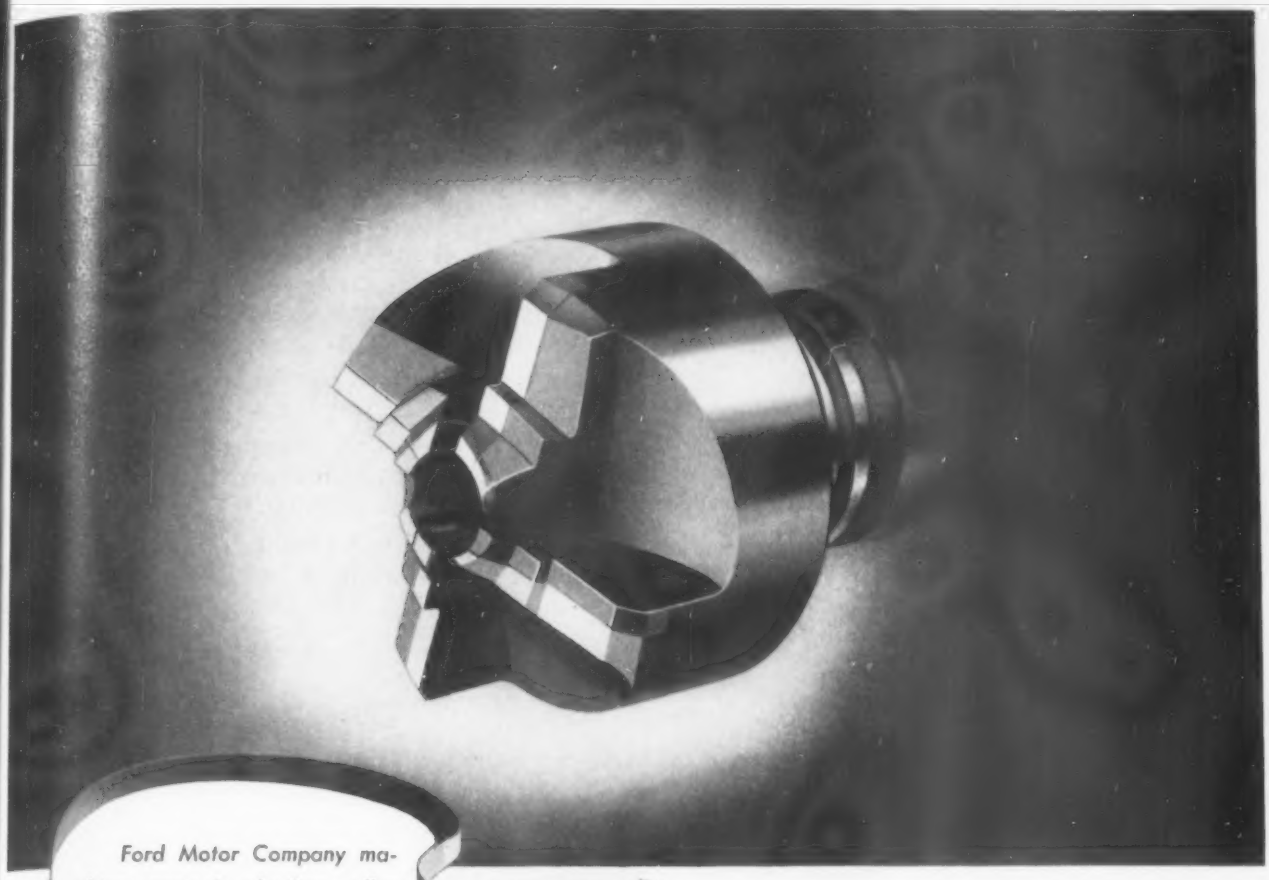
MANUFACTURED of Special Alloy Steel, hardened and ground throughout, these Die Heads (Model "T" series) are expressly made to cut accurate threads on long production runs. They are designed to use Tangent Chasers—giving long chaser life; permanent throat; uniformity of finished work throughout the entire life of chasers and interchangeability of chasers.

Send for literature

Also ask for literature on Collapsible Machine Tap; Self Opening Die Heads; Thread Milling Machines; Tapping Machines and Roller Pipe Cutting-off Machines.

MURCHEY MACHINE & TOOL CO.
Department T
DETROIT 26, MICHIGAN

MURCHEY



Ford Motor Company machines ports in aluminum alloy aircraft cylinder heads with this Eclipse carbide tipped tool.

FASTER · BETTER · CHEAPER

A threat and a promise for the future—The urgency of war production has revealed to aggressive manufacturers tremendous possibilities in using tools "engineered-to-the-job as opposed to the overall use of standard tools regardless of application.

Ask yourself the question: To what extent may your position in future marketing hinge on the recognition of advances made in special tooling?

Eclipse engineers have 30 years of "know-how" behind them and whatever your problem they, no doubt, have solved a similar one. You can add their experience to your engineering facilities without cost.

ARMY E NAVY

Do you have our catalog number 43?

ECLIPSE COUNTERBORE CO.

Founded thirty years ago

DETROIT AND FERNDALE, MICHIGAN

THE *Carbide* AGE

CARBIDE CUTTING TOOLS ARE REVOLUTIONIZING PRODUCTION

The greatest contribution to metalworking progress . . . machining metals at *woodworking speeds and feeds* . . . and even higher . . . now possible with **WESSON** Carbide Cutting Tools. Speeds of 20,000 surface feet per minute, feeds of 260 inches per minute, now attained in hard, tough "light metals". And *alloy steel* is being face-milled by new design carbide milling cutters, having negative rake and helix angles, at a speed of 3500 surface feet per minute, and a feed of 30 inches per minute . . . with *greater precision* and *finer finishes* than ever before possible.

"The Carbide Age" in cutting tools offers new opportunities . . . *and new competition* . . . to all manufacturers in metalworking industries . . . *opportunities* for greater production at lower costs . . . *new competition* for those who fail to retool with Carbides.

WESSON is prepared . . . through pioneering leadership and long experience in design and production of carbide tools . . . to help you NOW to plan your retooling. Write, wire, or phone . . .

WESSON COMPANY, DETROIT 20, MICH. (Ferndale Station)

No other cutting material or metal-removing technique in the history of manufacturing, has produced such a revolution as have carbide cutting tools. WESSON Carbides produce "high polish" finishes that often eliminate further machining . . . assure greater precision . . . longer tool-life . . . less frequent re-grinding . . . greater speed . . . lower costs . . . and thereby, competitive advantages. Priorities on future deliveries of WESSON Carbide Tools can be established by planning your retooling program now.

VAN NORMAN "Packaged Heating"

A Van Norman Packaged Heating setup for surface hardening a gear section of a triple-cluster gear. The gear teeth are hardened to 55-57 Rockwell C in 20 seconds which includes 13 seconds heating and 7 seconds for quenching. Depth of heat penetration is .035" to .045". The teeth of the small gear section as well as the larger middle gear section are also hardened to 55-57 Rockwell C. Small gear is hardened in 16 seconds — 10 seconds for heat and 6 seconds for quench. The large gear is hardened in 25 seconds — 17 seconds for heat followed by an 8 second quench.

ANNEALING

BRAZING

FORGING

MELTING

Van Norman High Frequency Induction Heating Provides a most effective and economical method for Hardening, Brazing, Soldering, Annealing, Forging, Melting...ALL WITH ONE UNIT!

The Van Norman High Frequency Induction Heating Unit gives manufacturers and job shops a *complete, ready-to-use* "Power Package" that fills practically all average heating requirements for hardening, brazing, annealing, forging, etc. And best of all, the Van Norman "Power Package" does all these jobs in seconds or minutes as compared to hours required by previous processes. Because the heat penetration is quick and uniform, there is better uniformity in the finished product since scale and warpage are eliminated in practically all heating applications.

Changing from one job to another, such as hardening to hardening, or from hardening to brazing is quickly accomplished, too. All that the operator has to do is . . . select the proper heating coil and workholding fixture for a job . . . set the proper time cycle . . . tune the machine—all these operations take but a few minutes—and he's ready to perform the work.

Add up the savings in time, the economy of operation, the ease and speed of changing from one job to another, and the wide range of work that can be done and you'll find the Van Norman "Power Package" pays for itself out of savings in very short time.

Investigate Van Norman High Frequency Induction Heating. Find out what it can do for you. Write for catalog and details.

VAN NORMAN COMPANY

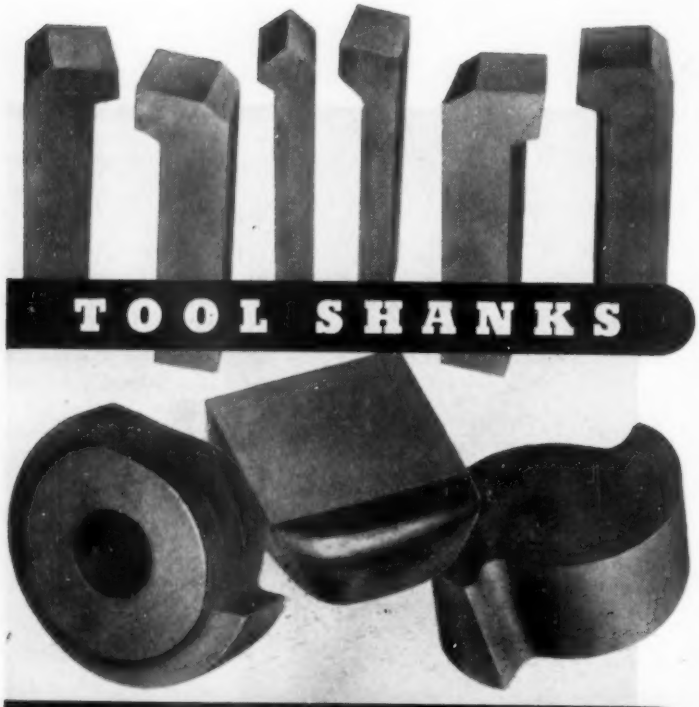
ELECTRONICS DIVISION

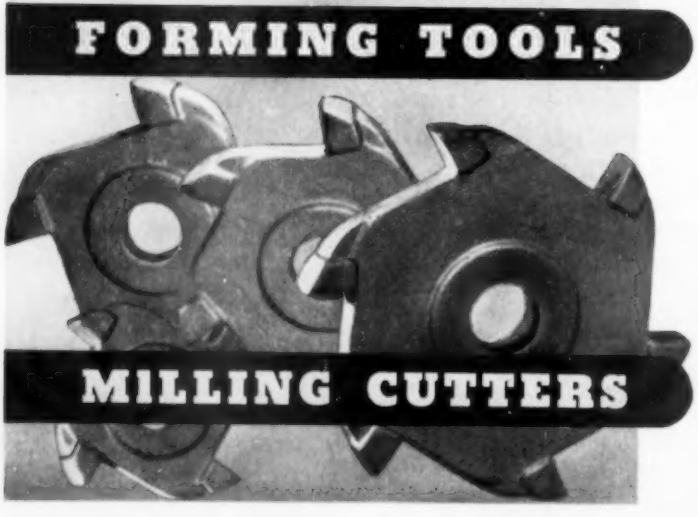
SPRINGFIELD 7, MASSACHUSETTS

"It pays to Van Normanize"

Better, Longer-Life Tools

WITH MEEHANITE





YES, cutting tools are weapons, too . . . so treat 'em right. If they can perform better and longer, then America's machines can deliver on time the goods that war's climax demands.

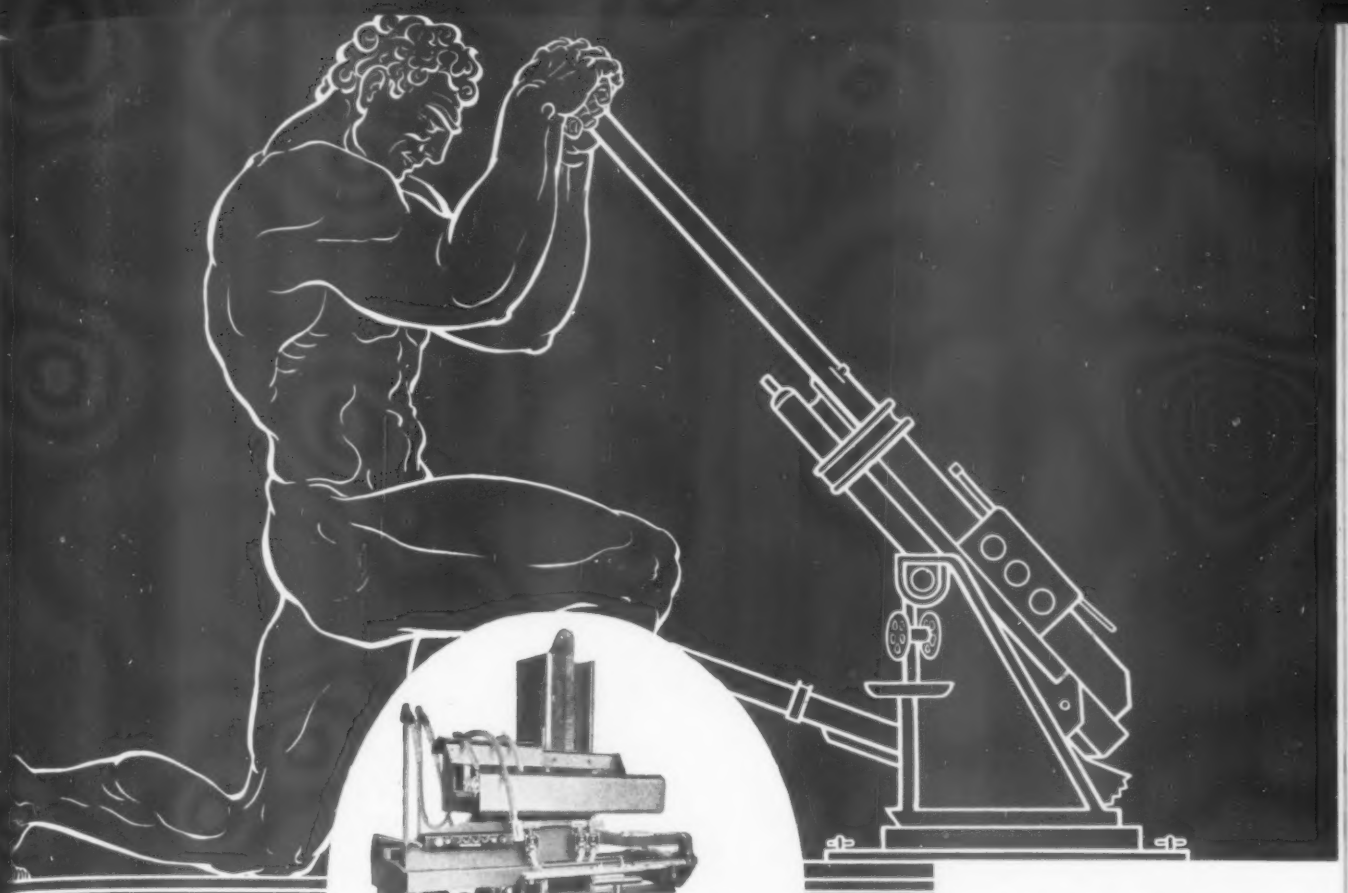
Cutting tools *can* perform better and last longer—even in the hands of less experienced workers—when they are Cooper-Bessemer-made of Meehanite, tipped with cemented carbide. Meehanite tool shanks, forming tools, milling cutters and many special purpose tools give you numerous unique advantages — greater vibration damping capacity, less loading in operation, easier and less machining before tipping, and lower cost.

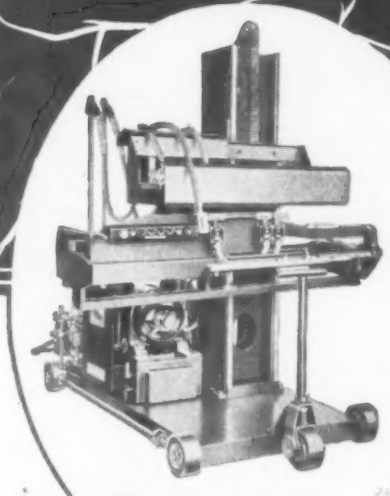
Hundreds of shops are using these Cooper-Bessemer tools today. They are available promptly, ideal for any plant equipped to tip its own tools.

Samples furnished upon request, so you can judge their value by performance in your own plant. Ask also for our Bulletin 53-T-2.

THE Cooper-Bessemer CORPORATION

DEPT. E., MOUNT VERNON, OHIO





Oilgear furnishes thousands of pounds of pressure to force gun barrels back against recoil, also the rapid reciprocation which enables gun to return to "battery" as in actual firing.

Latest Model Exercise Machine *

Guns get a move-on when Oilgear powers the push

A Gymnasticator, as you might guess, is an exercise machine. But this time it's for the recoil mechanisms of guns—these too have to be tested before they can be trusted. The job of exercising the recoil was formerly done by hand. It took hours and was inadequate. Now it's done with Gymnasticators—under conditions that actually and accurately simulate rapid fire—and the job takes *minutes*.

This too is another success story for Oilgear . . . the Fluid Power system that provides, among other things as in the case of Gymnasticators, tremendous power in small space, with rapid reciprocation. Possibly you need just this . . . *or* steplessly variable speed control . . . *or* hairline accuracy in control of movement . . . *or* force without motion . . . *or* any of a dozen other highly interesting functions for designers of post-war machines. The combination of experience and function which Oilgear engineers and Oilgear systems can bring to you may provide the right happy ending to your story too. Now is the time to find out . . . THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wisconsin.

*Mfrd. by Jackson Hydraulic Machine Co., Inc., Rockford, Ill.

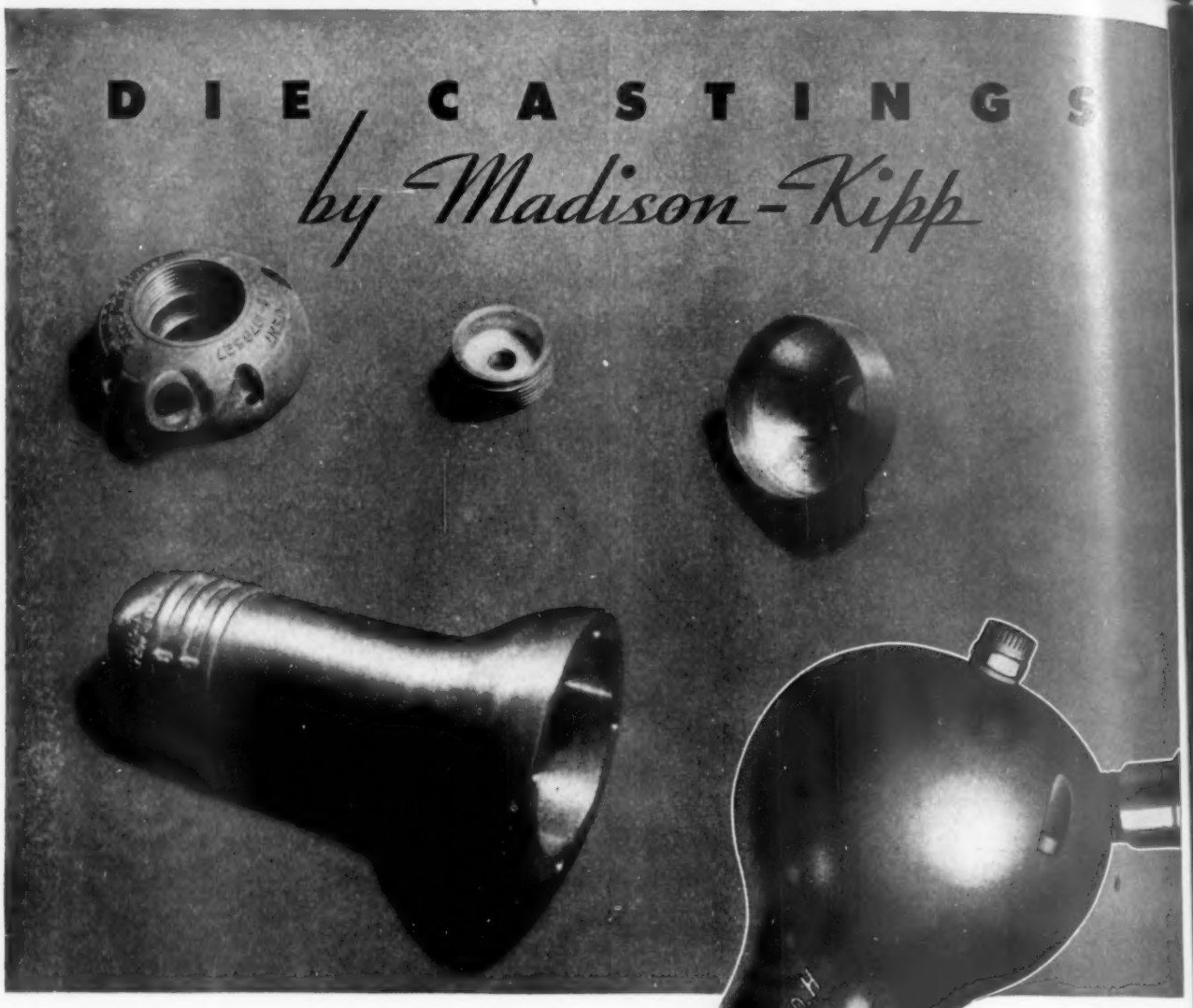
ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds?
2. Obtain automatic work cycles, variable speeds in either direction . . . with or without pre-set time dwell?
3. Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities?
4. Obtain extremely accurate control of either position or speed of a reciprocating member?
5. Apply accurately variable pressure either static or in motion?
6. Closely synchronize various motions, operations or functions?
7. Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel?
8. Obtain continuous automatic reversing drives at constant R P M or over a wide range of speed variation?
9. Obtain accurate remote control of speed and direction of rotation, rates of acceleration and / or deceleration?
10. Obtain constant horsepower output through all or part of a speed-range?
11. Obtain automatic torque control?
12. Obtain accurately matched speed of various rotating elements?
13. Obtain constant speed output from a variable speed input?
14. Obtain full pre-set automatic control, elimination of problems of shock, vibration, etc.?

You Need Oilgear!

OILGEAR

Fluid Power



A SUPERIOR PROCESS

. . . AND A SPECTACULAR PRODUCT

The Die Casting process offers the product designer almost unlimited opportunities to add pleasing appearance, light weight and improved strength at an over-all cost saving. In this advertisement we illustrate the effective use of die castings in one of the most spectacular tools brought out in the past decade.

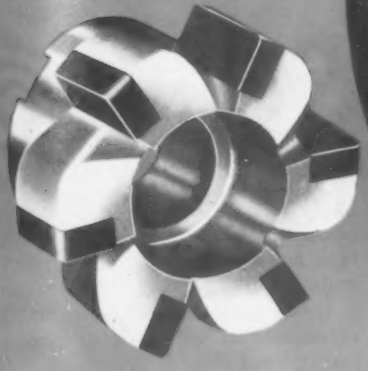
MADISON-KIPP CORPORATION
209 WAUBESA ST., MADISON 4, WISCONSIN, U.S.A.

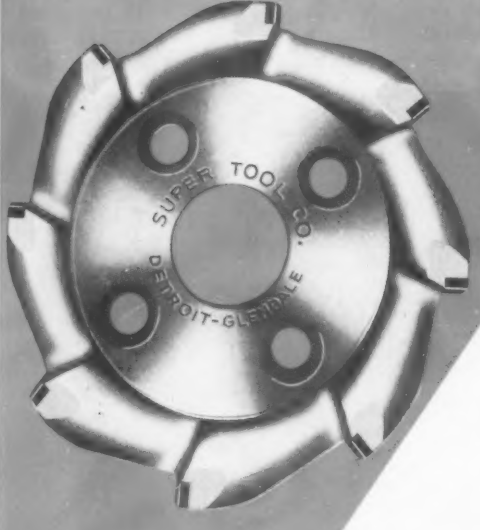
THE MODEL H
KIPP *air* GRINDER

Every toolmaker, every tool crib, every machine shop and thousands of production jobs need a model H Kipp Air Grinder. Because of expanded facilities the delivery position on high ratings has been measurably improved. Accessories in reasonable quantities can usually be shipped out of stock. Madison-Kipp Air Grinders were developed by practicing tool makers so they are practical. They usually pay for themselves on a single job.

IF YOU ARE DOING PRIORITY WORK, *Order Today!*

$29.75 Model H





HERE'S SUPER CARBIDE TIPPED Economy FOR YOUR FACE AND END MILLING JOBS!

Faster cutting, cleaner cutting, finer finishes, greater accuracy . . . these carbide tipped efficiencies are now available for your face milling and shell end milling jobs. For Super Tool engineers have developed this new line of Carbide Tipped Shell End and Face Mills!

Here's another step forward in carbide tipped standardization! These cutters are available in standard sizes, both for non-ferrous materials and in the Super NEGRAK (negative rake) type for cutting steel. They are manufactured on a production basis and the shell end mills may be purchased in the left-hand type at standard prices. When you buy a Super Carbide Tipped Face Mill or Shell End Mill, you enjoy economies that start with the first cost and continue through every operation of the cutter's exceptionally long life.

Super Carbide Tipped Shell End Mills and Face Mills are worthy additions to the line of Super Carbide Tipped Tools—tools that are setting new records of performance and economy on all types of cutting jobs the country over. Write TODAY for details of the complete Super Tool line including these new Super Shell End and Face Mills.

Let us send you this literature giving complete details and prices of Super Shell End and Face Mills

SUPER TOOL COMPANY

Carbide Tipped Tools

21650 Hoover Rd., Detroit 13, Mich. 4105 San Fernando Rd., Glendale 4, Cal.

The world's largest magnesium sheet and strip mill has recently gone into production.

Synthetic sapphires and rubies for the jeweled bearings of instruments and for spray nozzles, gages and spinnerets cost from three to six cents per carat while diamonds for this purpose cost about three dollars per carat. The making of these is an American war baby with a future.

NE alloys now make up as much as 20% of the tonnage of steel for aircraft.

A way has been found to put the "flags" (characteristic of natural bristles) on the ends of synthetic bristles for use in paint brushes.

The American chemical industry promises that it will employ more workers after the war than it did before.

Bituminous Coal Research, Inc., supported by the industry, has announced a $2,500,000 program, covering five years, with improvement in the use of soft coal as its object.

Dip-painted parts are being passed through an electrical field which removes the "tear-drop" in which the excess paint collects.

Electronic traffic control may replace the familiar signs and lights by signalling the driver through his dash radio.

The strongest natural fiber is Ramie, cultivated in Egypt 4,000 years ago. It is now being grown in this country and, if practical processing methods can be devised, it is expected to appear among our new textiles.

The new Orthicon camera has an "eye" composed of 400,000 pieces of light-sensitive silver which store voltage proportional to the light cast on them. It will be used in television and is said to be ten times as efficient as the iconoscope previously used.

Photo-electric cells check hand grenades at the rate of 4,000 per hour. When a defective unit appears on the conveyor, the mechanism rings a bell, lights a lamp, puts a dab of paint on the grenade, and makes a mark on a chart.

A new process for drying the paint on army tanks does the work in four minutes while the operator drives the tank through the "oven."

The use of the thyratron tube as a rectifier makes possible the use of an A. C. current supply to drive D. C. motors, the advantage being in very exact control of speed.

Extremes of temperatures encountered in flying have made necessary the development of new and better cements to replace the Canada balsam formerly used in the making of lenses.

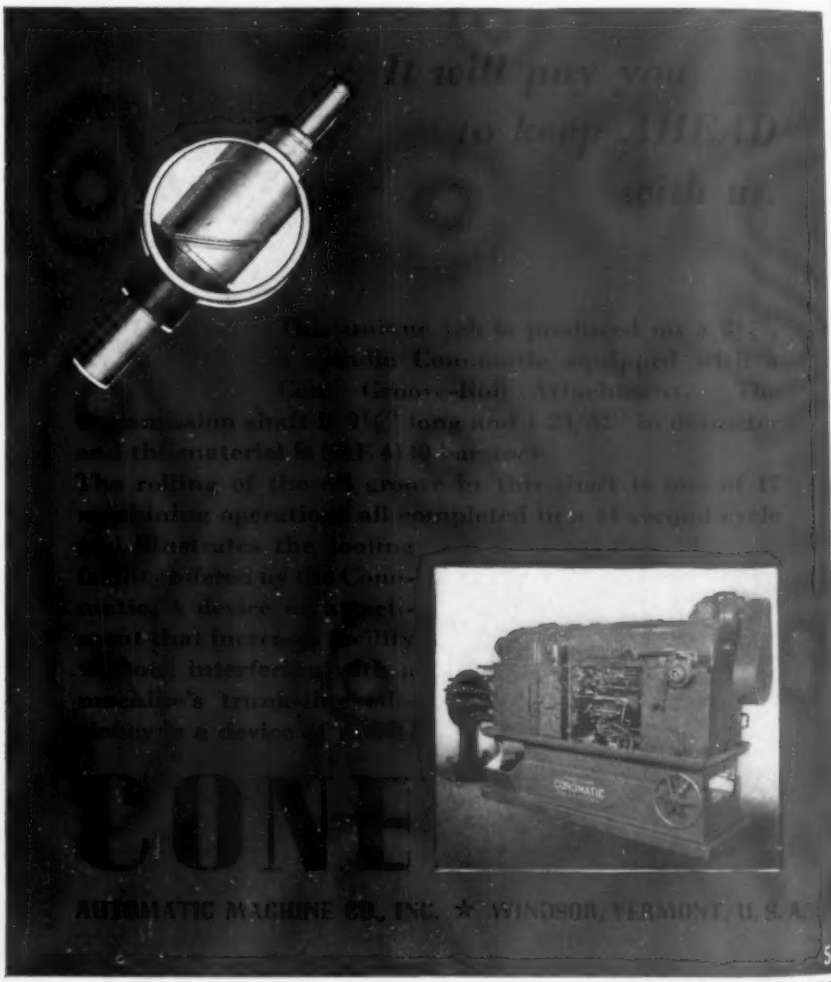
The cost of Diesel-produced electric power is expected to be cut in half as the result of war-time developments.

Street cars designed for post-war production will be lighter, quieter, better looking, and more economical in operation. They will have more comfortable seats and the windows will be higher to give strap hangers a better view.

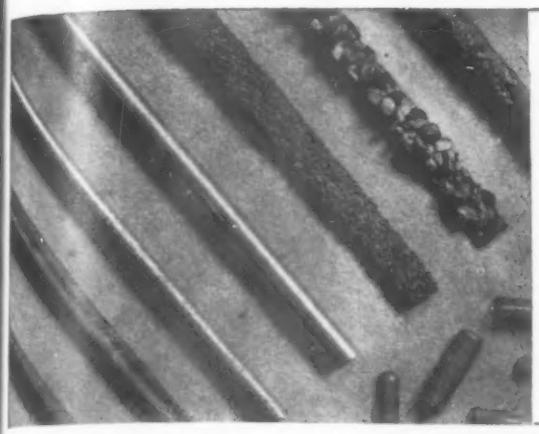
A new fluorescent lamp, about the size of a marble, uses only two cents worth of current a year.

A new electronic method of sorting metals detects differences in material, alloys, heat treatment and thickness.

Success of the "bazooka" against enemy tanks has called public attention again to the rocket or reaction engine as a source of power. Such a motor has been constructed, for experimental use, that develops 260 horsepower for each pound of its weight. One horsepower per pound is the approximate output of the lightest internal combustion engines.



HAYNES STELLITE RODS—*For Every Type of Hard-Facing Application*



What Hard-Facing Is — Hard-facing is the process of welding on to wearing parts a protective coating, edge, or point of a hard metal. This procedure makes critical parts of machines and equipment last from 2 to 25 times longer. Haynes Stellite Company has a rod for every type of hard-facing application.

Types of Rod Available

Stellite Rod — the original non-ferrous cobalt-chromium-tungsten hard-facing alloy — available in three different grades — high in "red hardness," highly resistant to abrasion and corrosion — applied by oxy-acetylene or electric-arc process.

Hascrome Rod — iron-base hard-facing rod containing chromium and manganese — work-hardens under impact — applied by oxy-acetylene or electric-arc process.

Stellite "93" Rod—iron-base hard-facing alloy containing more than 40 per cent of alloy ingredients — hard and abrasion resistant — applied by oxy-acetylene or electric-arc process.

Haystellite Inserts — cast tungsten carbide in 13 standard shapes and sizes — extremely resistant to abrasion — generally applied by oxy-acetylene process with high-strength steel rod as binder.

Haystellite Tube Rod — tungsten carbide grains of 9 standard screen sizes in high-strength steel tubes—extremely wear-resistant —applied as hard-facing rod, generally by oxy-acetylene process.

Haystellite Composite Rod — tungsten carbide grains of 4 standard screen sizes distributed in high-strength steel binder — extremely wear-resistant — applied as hard-facing rod, generally by oxy-acetylene process.

Write for descriptive price lists of Haynes Stellite hard-facing materials.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

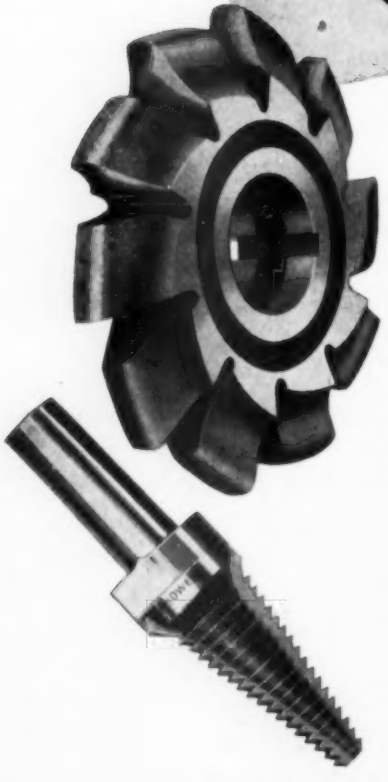
Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite" are registered trade-marks of Haynes Stellite Company.

FORM RELIEVED CUTTERS

are economical when you have to mill intricate shapes and outlines



WHEN CONSIDERING FORM CUTTERS, NOTE THE FOLLOWING: There are an infinite number of shapes, both symmetrical and irregular in outline, which can be milled efficiently and economically with Midwest Form Relieved Cutters. These cutters, provided with eccentric relief behind the cutting edges, always maintain the original outline of form when they are sharpened by grinding the faces of the teeth. However, conditions are so varied in the application of form cutters, no definite rules can be offered for making a proper selection as to type and form. When considering form cutters, send a blueprint of part to be milled; outline the cutter on the surface to be milled; furnish all dimensions of the form shown, with tolerances; specify arbor diameter, keyway size, and rotation. On unsymmetrical forms, designate below the outline, rotation, as "bottom going" or "bottom coming." Whenever possible, form cutters should have undercut teeth, the degree depending upon operating conditions. When sharpening a form cutter, the amount of undercut which is marked on the cutter should be preserved, since the form was corrected for this exact amount of rake . . . Other examples of Midwest Form Relieved Cutters may be found in Midwest's catalog 17 of Precision Metal Cutting Tools.

Your Security and Freedom depend on your Country Winning the War. There is no alternative. Your Country needs your Fighting Dollars for Victory. Invest them Now in United States Bonds and Stamps.

END MILLS • SLEEVES • COUNTERBORES • SPECIAL TOOLS • DRILLS
REAMERS • FORM TOOLS • CARBIDE TIPPED TOOLS • ADJUSTABLE HOLDERS

MIDWEST TOOL & MFG. CO., 2364 W. JEFFERSON AVENUE, DETROIT 16, MICH.

MIDWEST *Precision* METAL CUTTING TOOLS

FAST · ACCURATE · RUGGED

"Quality" Adjustable Limit Snap Gages

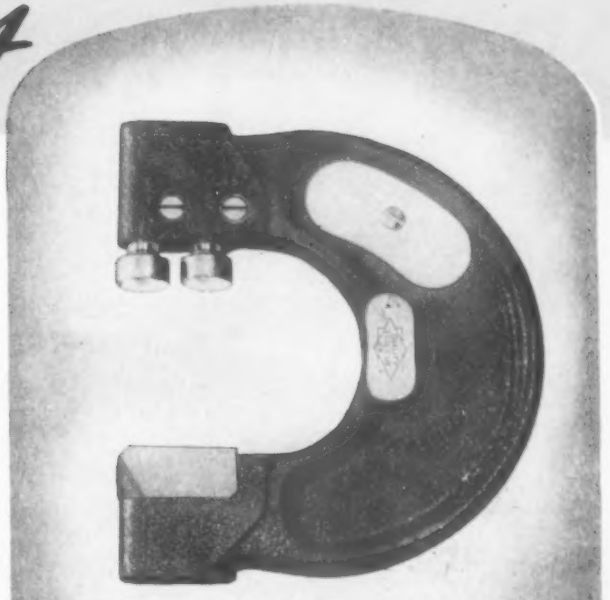
HEAVY DUTY A.G.D. MODEL "C"

Acclaimed for its ability to maintain accuracy even with hard usage. The contact anvils and gaging buttons are of hardened and tempered tool steel, ground, lapped and adjusted to size. They are held in place by an A.G.D. Locking Device. Assures quick and accurate inspection of duplicate parts. Round or square head buttons optional.

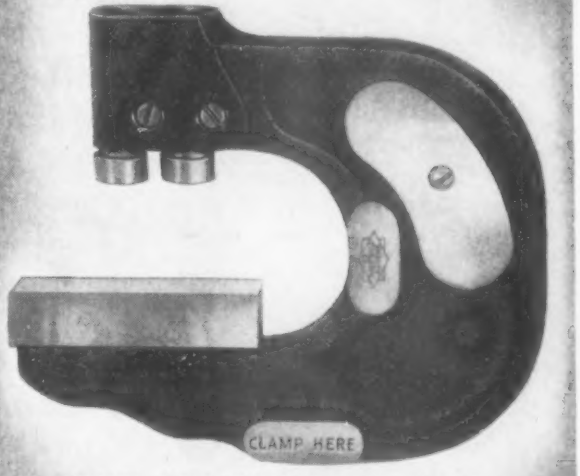
Write for Illustrated Price List

HEAVY DUTY "KWIK-CHEK" MODEL

Ideal for ease and speed in gaging odd or irregular-shaped pieces. Note the lower anvil extending beyond back edge of top gaging button for aid in gaging counter-bored work, and in lining up work before presenting it to the gaging anvils. An excellent gage for checking end measurements of any kind.



HEAVY DUTY A.G.D. Model "C"



HEAVY DUTY "KWIK-CHEK" Model

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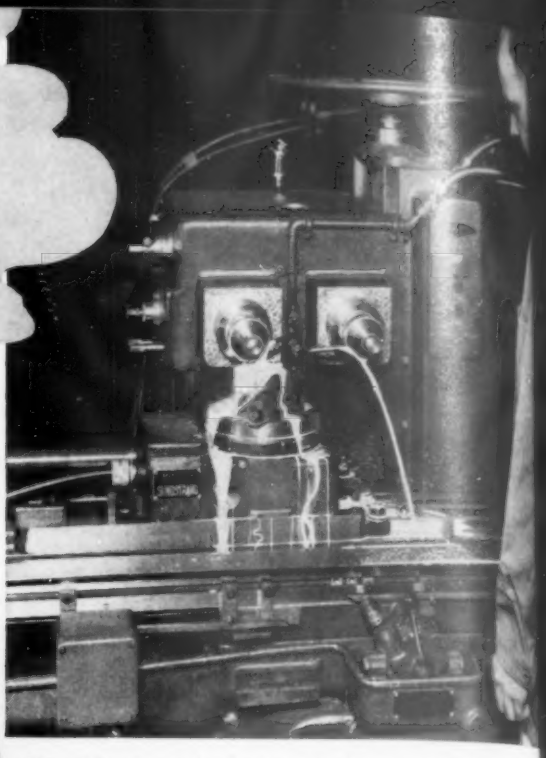
Here's what can be done with Standard Rigidmils

...to Solve Special Milling Problems

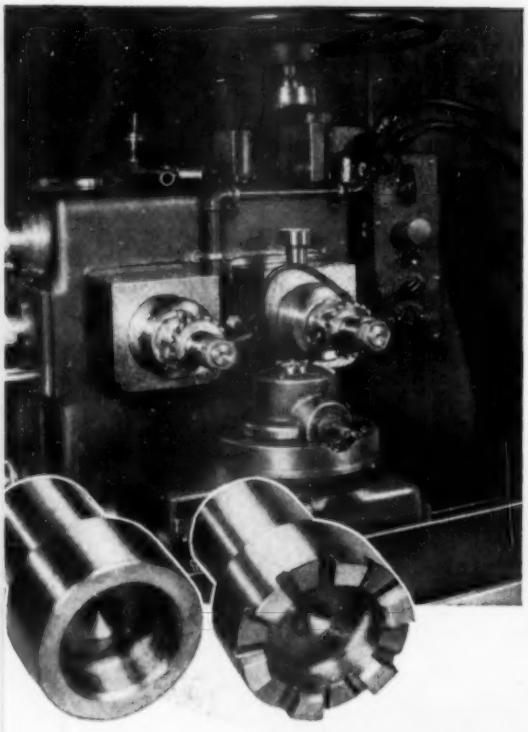


AUTOMATIC CYCLES in various combinations can be provided on Sundstrand Rigidmils by merely setting the dogs on the table to suit the job at hand.

STANDARD AUTOMATIC INDEX BASES manufactured by Sundstrand can be applied to Rigidmils for operations requiring rotary indexing in either horizontal or vertical planes.

SPECIAL HEADS can be supplied on Rigidmils because the standard head is a self-contained unit which can be easily replaced with a special head.

(Above) Loading and unloading of each part and starting each cycle is the only work required of the operator. The table and indexing cycle is entirely automatic.



(Below) Close-up of tool arrangement showing Sundstrand Automatic Index Base and Special Two-Spindle Milling Head.

(Above) Note the form of the teeth on this clutch drive shaft. Each tooth undercut on both sides requiring two cuts, one with a left hand and one with a right hand cutter.

How All Three Were Used to Solve This Problem . . .

The design of this drive shaft is such that the form milling of the workpiece would have to be done with either two standard machines or one standard machine with two handlings. The application of the automatic cycle and automatic index base and a two-spindle special milling head to the standard Rigidmil made it possible to perform the milling operations on one machine. The automatic cycle makes it possible for the operator to inspect or do other work because his duties at the machine require only one-half minute out of the five and three-quarters total minutes required in form milling the clutch teeth. Perhaps standard Rigidmils can be adapted to your special milling production problems. Our engineers will be glad to assist you in determining the most economical and productive milling method for your work. Call on them without obligation.

Additional Data...

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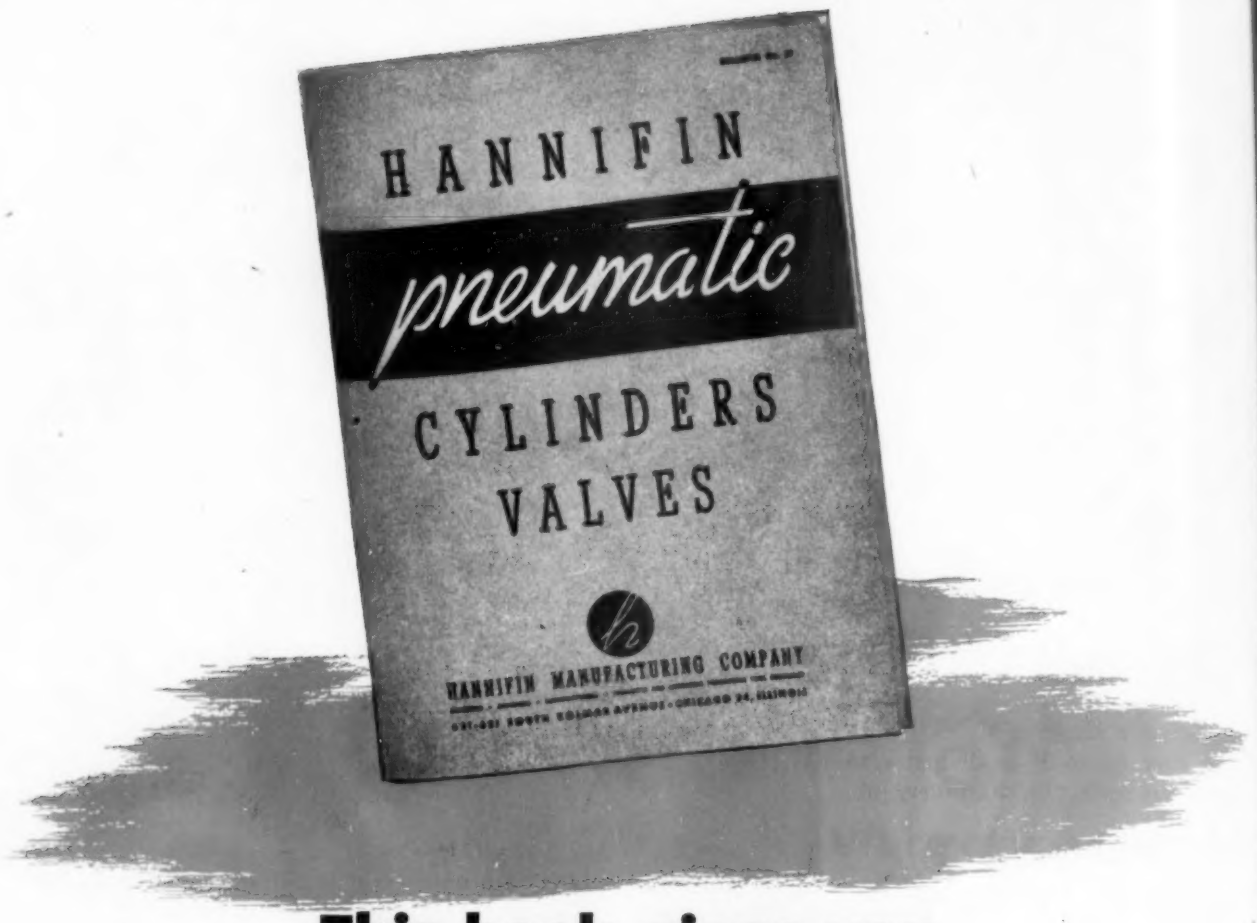

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PRODUCTION PERSPECTIVES

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

PRODUCTION PICTURE: For the first 3 months of this year war production averaged 3 per cent below last November-December record output....Losses here and there in overall munitions production are attributed to tightening of manpower, especially by the mandatory "below 26" draft.

BREAKDOWN: Guns, small arms ammunition, communications and electronics, combat and motor vehicles are slipping back....Invasion tools – aircraft and landing craft – last month hugged the spotlight. Both have enjoyed 9 to 10 per cent gains....Shipbuilding, Number 2 war industry, is back to levels of one year ago, and sharp cutbacks are imminent.

NUMBER ONE JOB: If aircraft production could win the war, victory would be in the bag....March witnessed the record-smashing output of 9,118 planes, the eclipsing of previous weight records by 9 per cent. March may have been the all-time top for volume....Ford's Willow Run bomber-an-hour record is the biggest news of the industry (see page 118).

MORE TOOLS: Continued manpower losses can be compensated for in some industries by additional machines....At least one WPB Industry Advisory Committee (Electric Motors) may soon set a pattern, demand more machine tools to offset the loss of younger workers.

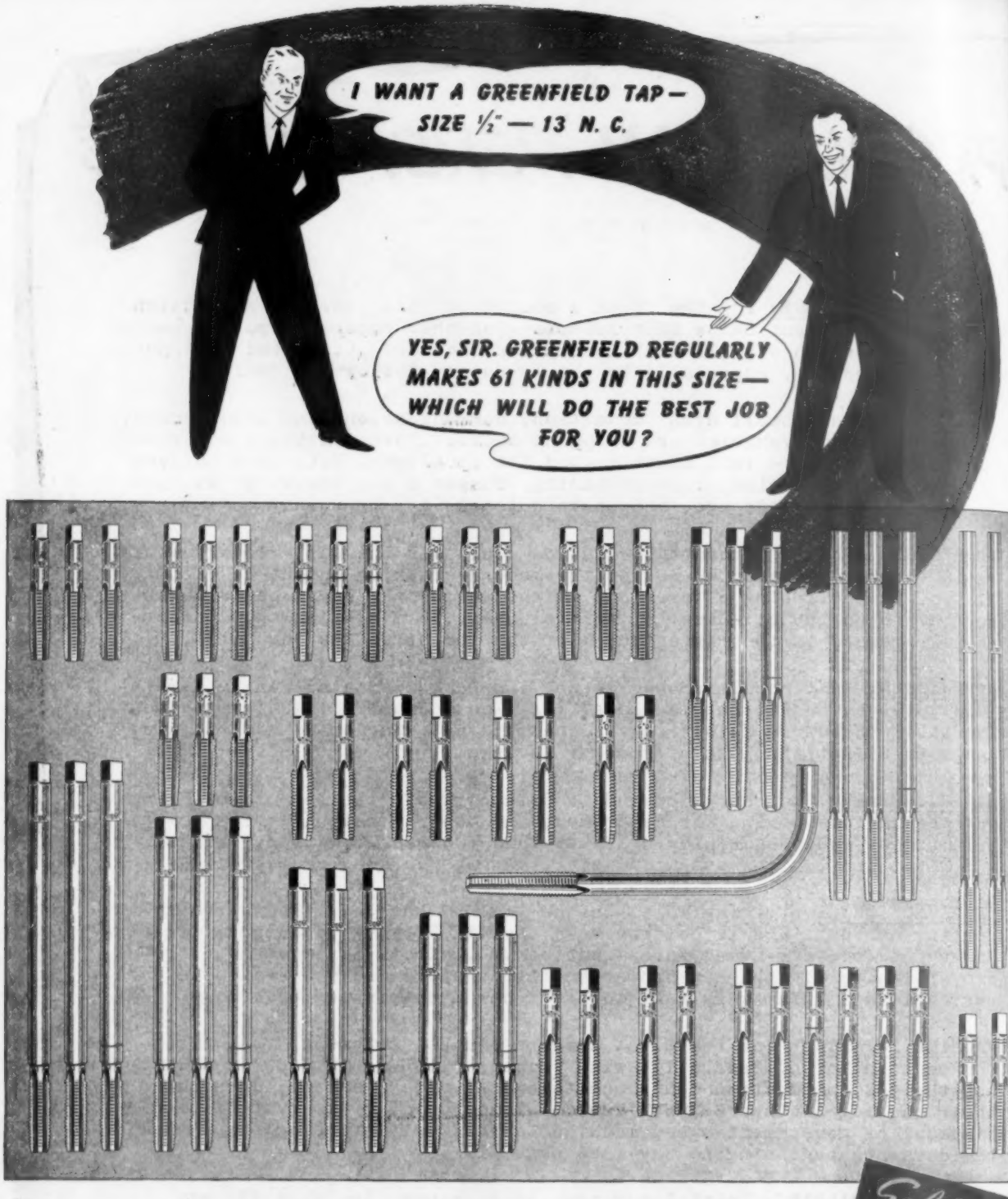
BIG VS. SMALL: What has happened to defenders of "little business" in war production?....The War Department says nearly half of every Army dollar goes to shops employing fewer than 500 men....Without fanfare, WPB is allocating new essential civilian jobs to smaller industries.

RECONVERSION: Everything waits on the tide of battle....Industry is getting nervous. WPB is holding down the lid, trying to compromise divergent industry-armed forces outlook....Detroit is a hotbed of reconversion talk. Though manpower and floor space are not available for car building, automakers want to order new machines now (see page 124).

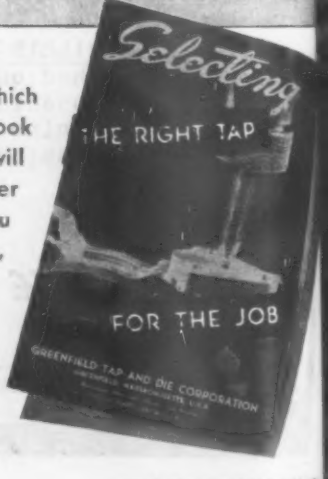
MACHINE TOOLS: Up for the first time in months, shipments rose 1.5 per cent in March. Orders likewise jumped, climbing 19.6 per cent. Nonetheless, production continued to exceed orders and builders cut their backlog another 6.9 per cent....Trade opinion is crystallizing on disposal of government-owned machine tools. Don't store or scrap them, builders are beginning to say (see page 113).

HIGH-SPEED MILLING: Initial advances on aluminum (see page 67) may soon be matched on steel....The University of Michigan's Dr. O. W. Boston and associate, Professor L. V. Colwell, have developed a converted-machine with cutter speeds approaching 36,000 feet per minute. A redesigned spindle is driven hydraulically.

LAST-MINUTE NEWS REVIEW OF MASS MANUFACTURING


I WANT A GREENFIELD TAP—
SIZE ½" — 13 N. C.
YES, SIR. GREENFIELD REGULARLY
MAKES 61 KINDS IN THIS SIZE—
WHICH WILL DO THE BEST JOB
FOR YOU?

IT'S TRUE. Shown above are the 61 different kinds of ½"—13 N. C. Taps which "Greenfield" lists in its catalog, not including special "Maxi" finish taps. Many look identical, but each has its own particular qualities and usefulness. . . . Which one will do the best job for you? That is a "$64 question" that Greenfield helps you answer in its new booklet "Selecting the Right Tap for the Job." If you need more help, you can call on Greenfield's staff of expert screw thread engineers for recommendations, or ask a Greenfield field service engineer to call.



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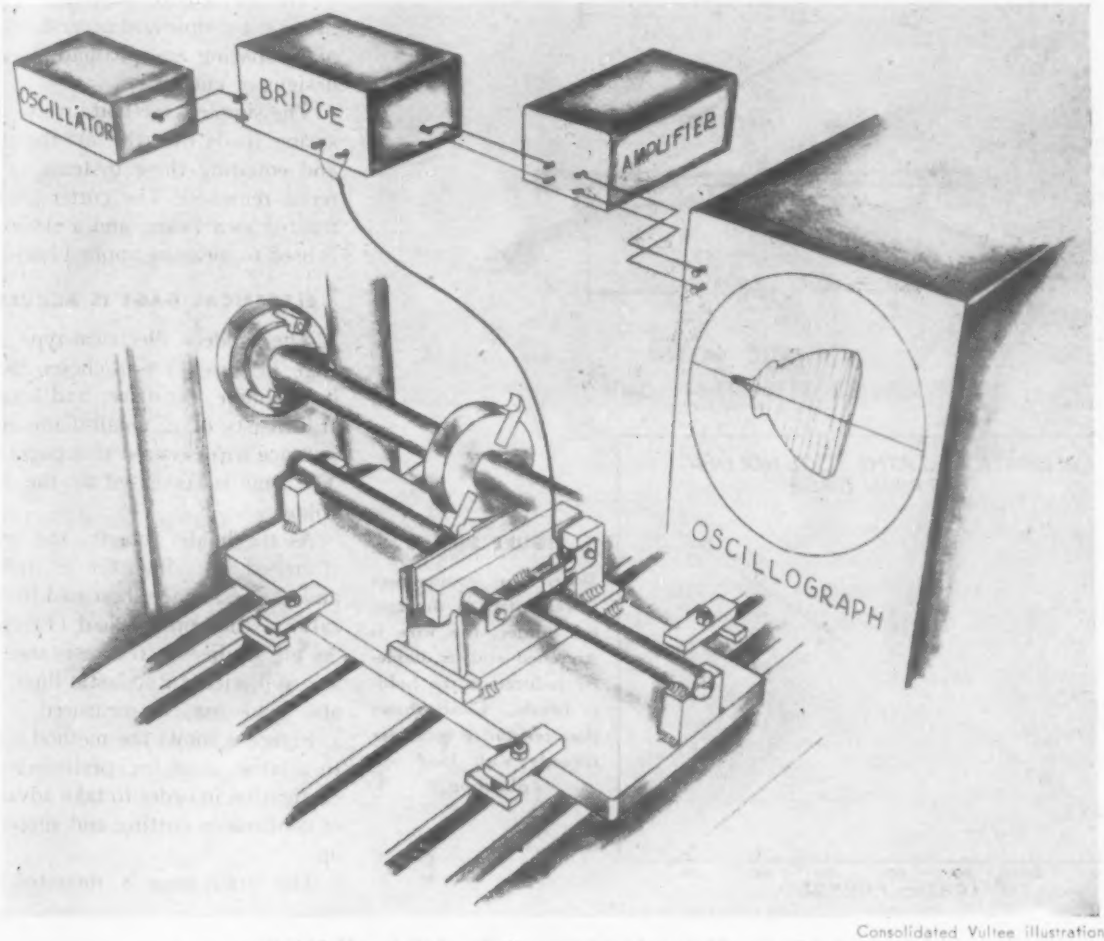
Why High-Speed Milling?

Conventional milling equipment cannot take full advantage of the machinability of aluminum alloys, according to production engineers who believe that the best way to remove metal is to make as few chips as possible. A redesigned machine and advanced methods of determining tool efficiency permitted applying speeds and feeds far beyond accepted practice



Consolidated Vultee illustrations

Method developed to evaluate milling cutters. To avoid rotating strain gage with the tool, the strain on the work is measured.

WALLACE E. BRAINARD
SUPERVISOR OF PLANNING AND RESEARCH
VULTEE FIELD DIVISION
CONSOLIDATED VULTEE AIRCRAFT CORPORATION

SLIGHTLY MORE THAN four years ago, the Vultee Aircraft Corporation, now the Vultee Field Division of Consolidated Vultee Aircraft Corporation, received what was probably the first large airplane contract. Recently the 10,000th airplane was completed. This was a two-place basic trainer. Its dual controls contributed to the requirement of a large number of aluminum-alloy forgings and castings which had to be machined.

Working upon the theory that the best way to remove metal is to make as few chips as possible, production men found that the feeds, speeds, and available horsepower of conventional milling machines did not permit taking full advantage of the machining properties of aluminum alloys.

An extremely rigid milling machine base was used as a starting point. A local electrical manufacturer cooperated by building a special water-cooled, high-cycle motor having high power and speed. Fast-loading fixtures were made, and rigid cutting tools were developed. It became apparent that excellent work could be obtained at feeds and speeds far beyond the range of accepted practice. Tool development by the cut-and-try method became inadequate, and a

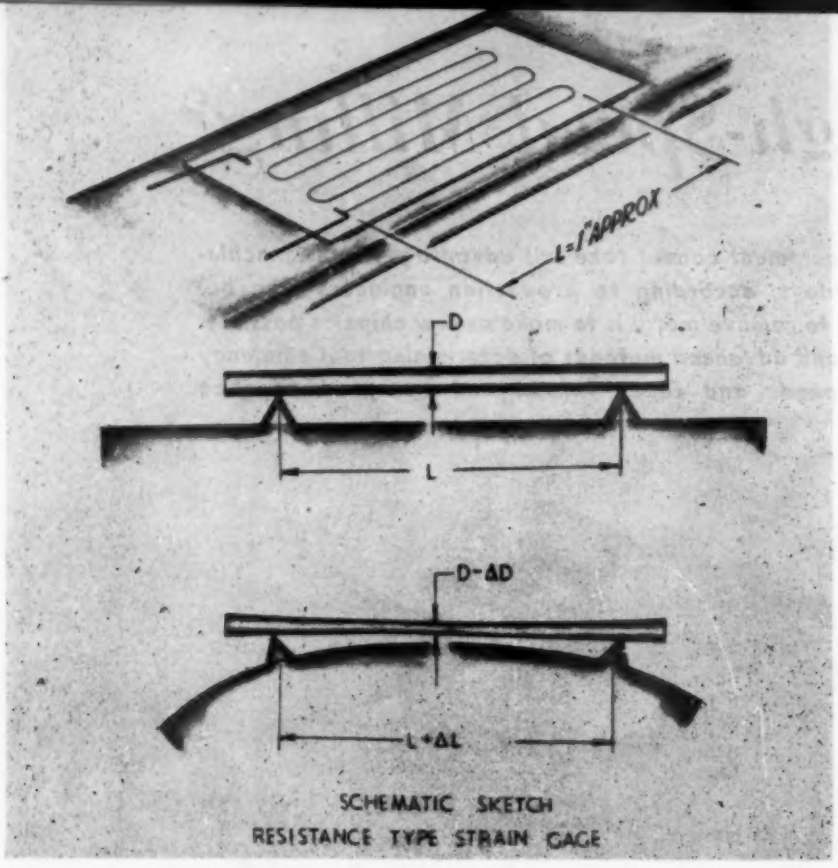


FIGURE 1 *(left)*

To measure applied loads on milling cutters, modern electrical type strain gage was chosen. It consists of a small diameter resistance wire secured to a paper base. The gage is cemented to the cutter holder.

search was made for some simple and effective method that would permit the necessary determinations to be made.

The immediate objective was to develop a simple and accurate method of comparing and evaluating various designs of cutters.

The simplest method involves measuring loads directly at the cutter, and equating these in terms of material removed. The cutter holder is treated as a beam, and a strain gage is used to measure applied loads.

ELECTRICAL GAGE IS ACCURATE

The modern electrical-type strain gage (Figure 1) was chosen because it is simple, sensitive, and accurate. It consists of a small-diameter resistance wire secured to a paper base. The gage is cemented to the cutter holder.

As the holder bends, the wire is stretched, its diameter is reduced, and the resistance increased in direct ratio to the applied load (Figure 2). As all strains on the resistance wire are well within its elastic limit, variable loads may be measured.

Figure 3 shows the method applied to a lathe, used for preliminary investigation in order to take advantage of continuous cutting and simple set-up.

The strain gage is mounted on a

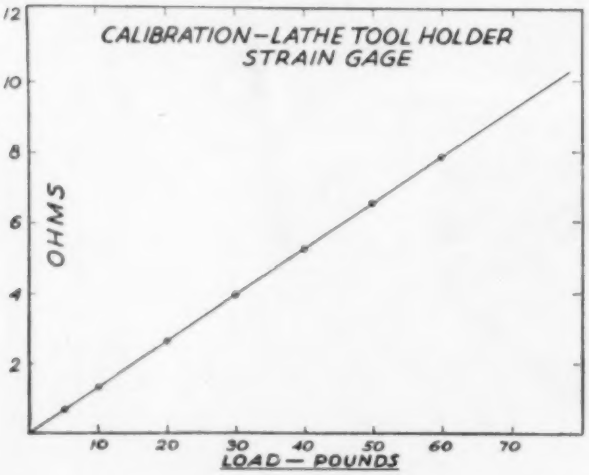


FIGURE 2 *(left)*

When the strain gage is cemented to the cutter holder, the wire is stretched and its diameter reduced as the holder bends. Chart shows that resistance increases directly with load application.

A MILLING MACHINE AT ITS BEST . . .

THE paragraphs below indicate to some extent the type of thinking which led to investigation of increased speeds and feeds for machining aluminum alloys. They also summarize to some extent the trend of present day metal working advancement. This material is abstracted from the paper by Mr. Wallace Brainard, presented at the last annual meeting of the American Society of Mechanical Engineers. Brainard was among the first production engineers to recognize the need for improved milling equipment, in the light of war-time needs and the advent of new materials.

●

"Consider the machining of a slot, and study the chips that result. Work has been expended in shearing the two side edges, the bottom edge and each surface. Additional energy has been expended in deforming the chip, and in heating it, the work, the tool and the coolant. Of these operations, the only useful ones performed were shearing on the sides and bottom of the chip.

"Improved casting, forging, cold pressing and other plastic forming methods, and better design practices involving the use of welding and brazing, have gradually eliminated the manufacture of chips for the scrap bins. However, present limitations of other processes are such that machining must be applied frequently to manufacture parts to exacting dimensions and good surface regularity.

"There are instances in which a modification of design might eliminate our slot example entirely. Or dimensional tolerances might be established within those practically attainable by casting or plastic forming. Obviously, the least work would be performed (though scrap would still be manufactured) if the slot could be produced by removing the metal in one piece. If the slot length is sufficiently small in respect to its area, we can sometimes do this very thing by utilizing the shearing action of a mechanical press notching die.

"Other operations resulting in holes, cutouts and surfacing, can be eliminated similarly, or simplified, by proper design, and by the substitution of manufacturing processes other than machining."

* * *

The trend, as seen by Mr. Brainard, is toward decreased use of machining on certain high production applications. Does this mean fewer metal removal tools will be applied to mass manufacture? Hardly. If anything, more will be required.

Advanced forming and milling methods permitted rapid production of 10,000 planes. This means that not only more fuselages were to be built, with a high overall requirement for machining certain parts, but more engines, more fittings, and more instruments were needed.

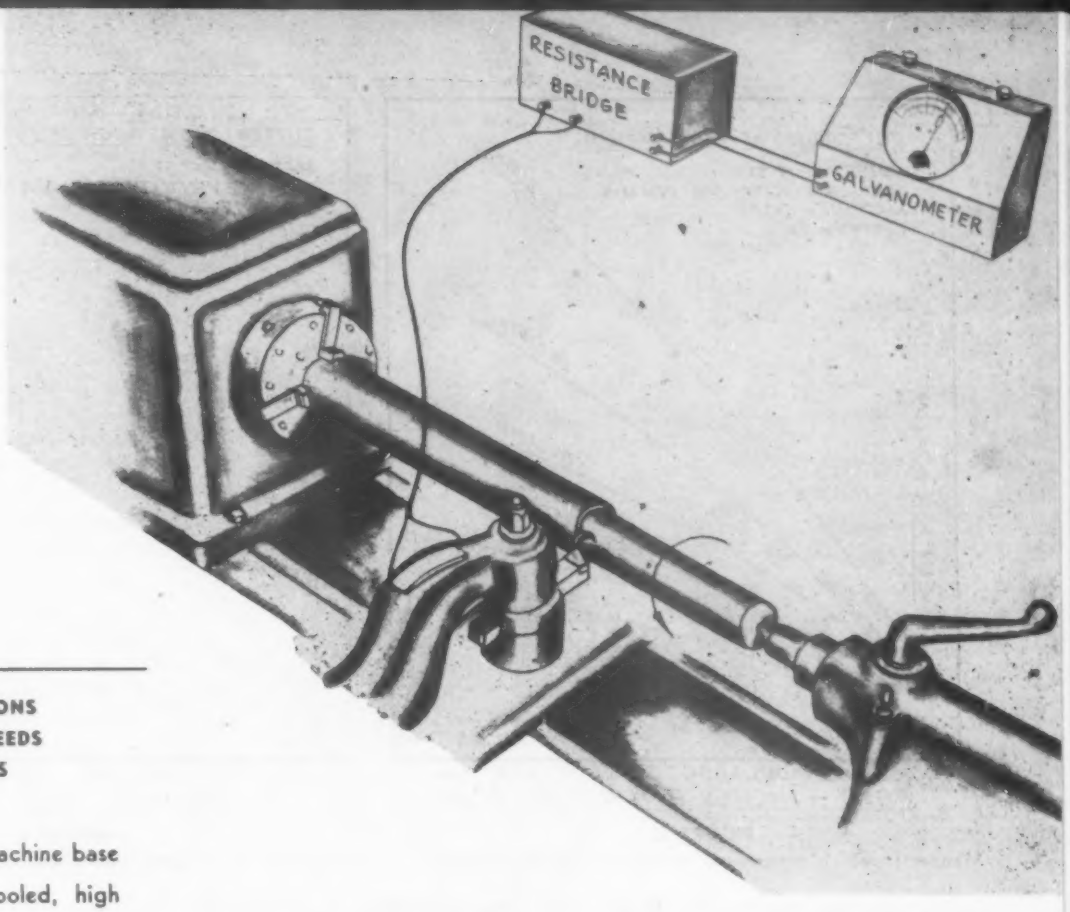


FIGURE 3.

Gage was applied to lathe for preliminary investigation in order to take advantage of continuous cutting and simple setup.

SPECIFICATIONS FOR HIGH SPEEDS AND FEEDS

1. Extremely rigid machine base
2. Special water cooled, high cycle motor
3. Fast loading, rigid fixtures
4. Rigid cutting tools, ground to proper rake angles for cutting depth

tool holder at a position of greatest deflection. The setup was calibrated in pounds loading, tangent to the work, by suspending known weights from a wire extending downward over the tool's cutting edge.

The blocks represent a conventional resistance bridge and galvanometer, used to measure the resistance change.

By this method, the relationships between cutter load, in pounds, and work surface velocity, were measured. It was determined that there was no change in load as surface velocity changed, for speed variations within the test range of 200 and 1500 feet per minute. This experiment was repeated for various feed and depth combinations, from light to heavy (Figure 4).

Figure 5 shows the manner in which cutter load was found to vary as the feed was changed. Curves for six different depths of cut were charted. Increased efficiency with greater cut depth is indicated because the curves lose their slope as feed is increased.

When the same data is replotted (Figure 6) to show the variance in load as the depth of cut is chosen, the curves more closely approach linear relationship.

Adoption of some method of evaluating cutter performance in terms of work and quantity of metal removed appeared advisable. Because of the elimination of the question, "Does surface velocity affect cutter load?", a simple answer to this problem became evident. By omitting the time factor, such items as horsepower and revolutions per minute were eliminated, and hence the ratio of load to chip area could be compared with any independent variable selected.

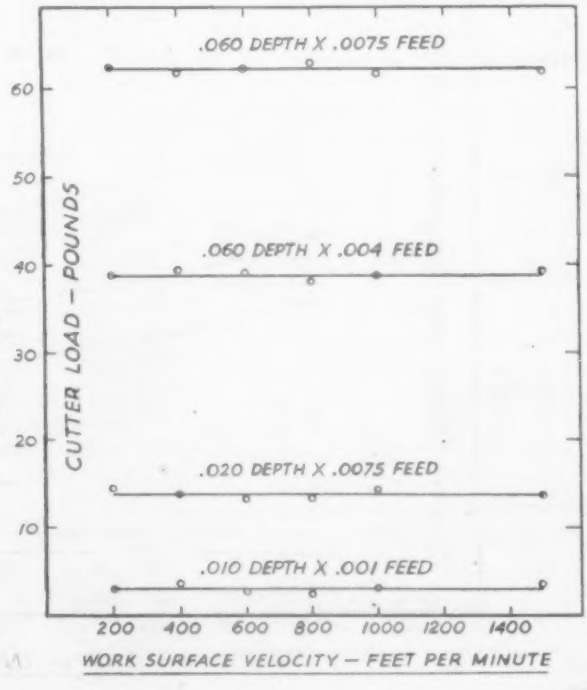


FIGURE 4.

Charting relationship between cutter load and surface velocity shows no change in the load as the surface velocity changes within test limits.

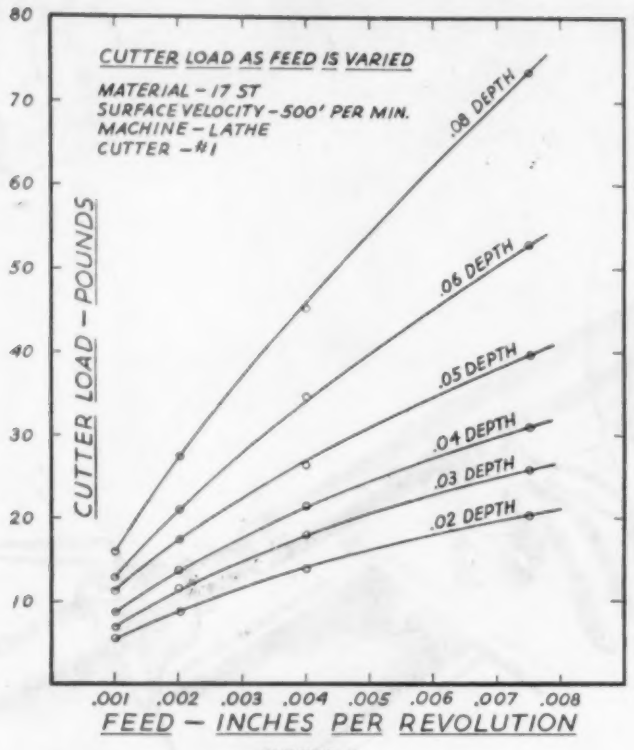


FIGURE 5.
Manner in which cutter load varied as feed was changed.

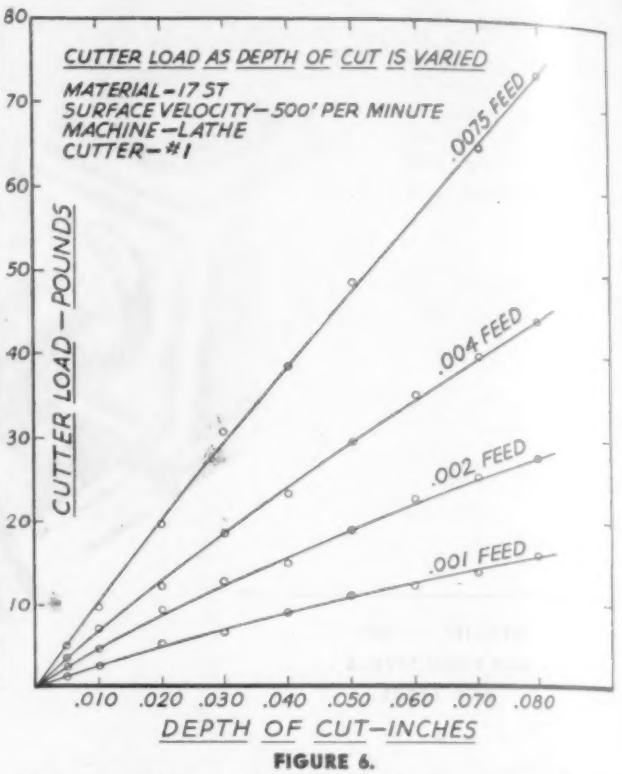


FIGURE 6.
Manner in which cutter load varied with changed depth of cut.

To express the idea simply, shear (or tear of the chip) is measured in terms of pounds per square inch.

Figure 7 shows a typical application. The chip shear, in pounds per square inch, is plotted vertically. The curves show how the shear changes as the cut depth is varied. Curves for different feeds are plotted.

By this method, the efficiency of cutters can be easily compared. The largest chip required a shearing load of 112,000 psi, an interesting comparison with the 37,000 psi actual shear strength of the material.

Having established a method of comparing tool efficiencies the idea is applied as shown in Figure 8.

This series of curves is for a group of tools having various side cutting rake angles, all other dimensions being identical. As the cut depth is chosen, the shear load is shown.

The cutter with 0° rake angle showed a comparatively erratic performance. The 5° cutter showed maximum efficiency at a medium depth, and 10°, 20° and 30° rake angle cutters increased efficiency as depth was increased, leveling out with the heavier cuts. The 40° rake angle cutter showed very consistent performance for all depths of cut.

The curve of Figure 9 is a computed average derived from a large

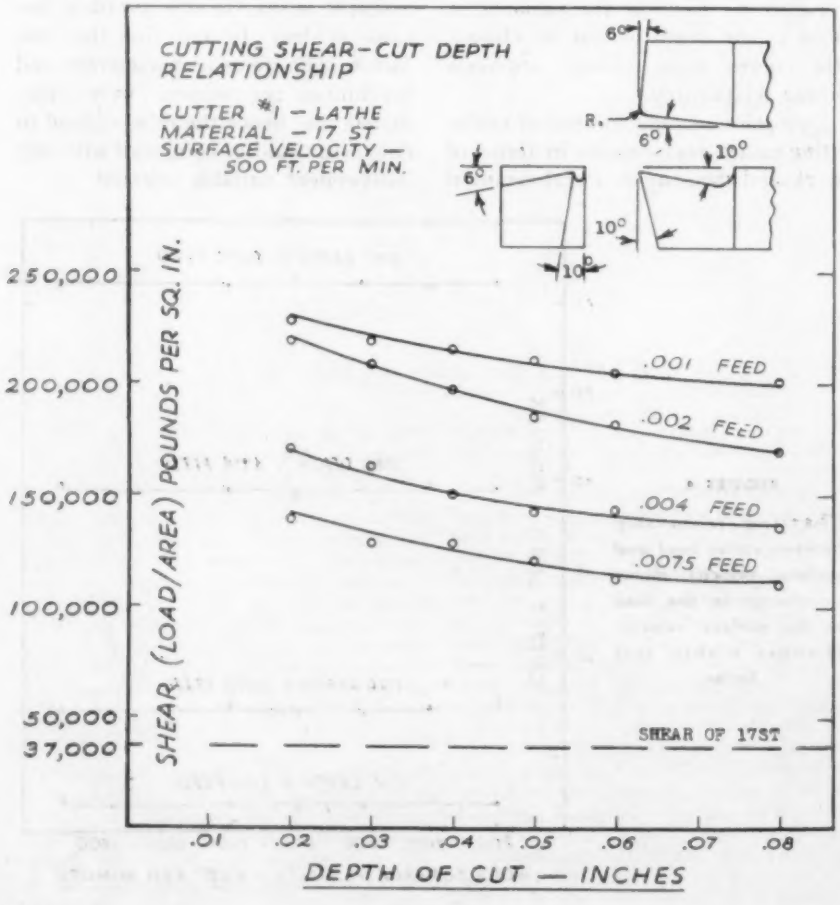


FIGURE 7.
Because surface velocity does not affect cutter load, it is possible to eliminate horsepower and revolutions per minute from calculations. Here, chip tear, or shear, in pounds per square inch, is related to depth of cut. The ratio of load to chip size can thus be related to any independent factor.

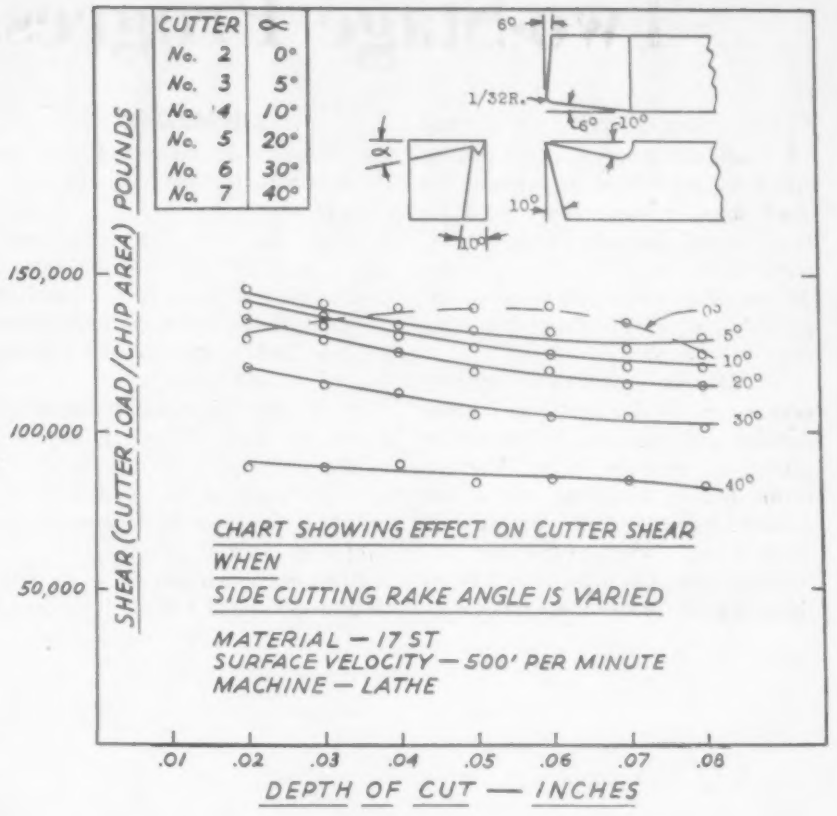
number of measurements at various depths and feeds, showing the change in efficiency as the rake angle is varied.

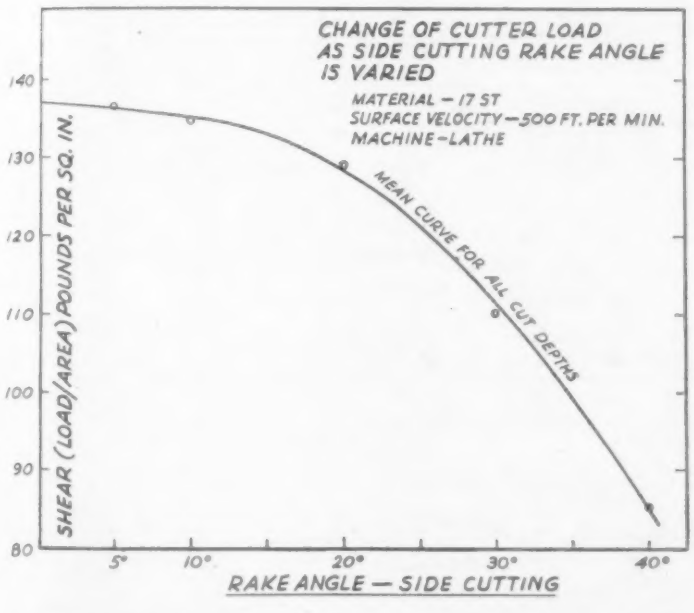
At present, investigation is being made of other aspects of cutter design, such as nose radius, back rake, side angle, and clearance angles. The program also includes coolant investigation, and the relation of tool life and surface finish to cutting efficiency.

The method developed to evaluate milling cutters is shown at the beginning of this article.

To avoid rotating the strain gage with the tool, the strain on the work is measured. Upon cutter impact, the work-holding fixture moves slightly against a heavy steel bar, which serves as a spring. The movement is approximately .001" per 100 pounds cutter load.

As the cut begins, the strain gage is stretched, and, through a bridge arrangement, serves to allow the voltage of an oscillator to produce a vertical trace upon a conventional cathode-ray oscillograph.





Above: FIGURE 8.

Left: FIGURE 9.

An automatic graph records the instanteous load on the cutter, in respect to time, since the pattern is composed of 1000 cycle traces, spaced 1/1000th of a second. The envelope of the image is read in the same manner as the curves previously shown are read.

The setup is calibrated by applying known loads on the work-holding fixture. The calibration can be instantly checked at any time during an experiment by means of a simple standard load substitution device. Photographs of the pattern are taken for study and analysis.

The experimental program has not developed sufficiently to allow the presentation of quantitative data at this time. However, some benefit may derive to those who are engaged in similar research from the description of these approaches to the solution of a common problem.

THE END

NEGATIVE RAKE — OR SHEAR CUT

WHILE the introduction of negative rake—or, as popularly termed, shear cut—has been coldly acknowledged by the conservatives, its evident merits are now so firmly established that its ultimate acceptance may be considered a foregone conclusion. "Hyper-milling", as coined by Firth-Sterling Steel Company, has already proven its worth in various modifications. Now patents are being applied for on a right and left curved-tooth milling cutter, designed for a shear cut without chatter. While the principle is old, the interesting thing is its adaptation to modern metal cutting.

The main advantage of negative rake—or shear cut—is that it reduces chatter and results in a smoother cut, reducing tool breakage, especially on interrupted cuts. Finally, it provides more cuts between grinds. All in all, it is conducive to increased production, the main objective sought in any tool. It is still subject to considerable experimentation and development, particularly since to date no hard and fast rules have been established for angles or shapes.

Two-Stage Progressive Die

LIN MAGER

THE INEXPENSIVE pierce and blank die shown is easily run by operators with little experience. No stock stops or stage stops need be manipulated. Because pilots are entered in the stock before the upper die descends, misregistration is impossible, and die breakage from this cause is avoided.

Stock layout is made to nest blanks, saving materials and permitting piercing and blanking stations to be placed on separate steels. The operator places the stock end at the scribed line on the lower die stamped "Start Line." Piercing the hole pattern also produces holes C and D in the scrap. He places these holes over the pilot pins E and F and trips the press, completing one part and piercing the next.

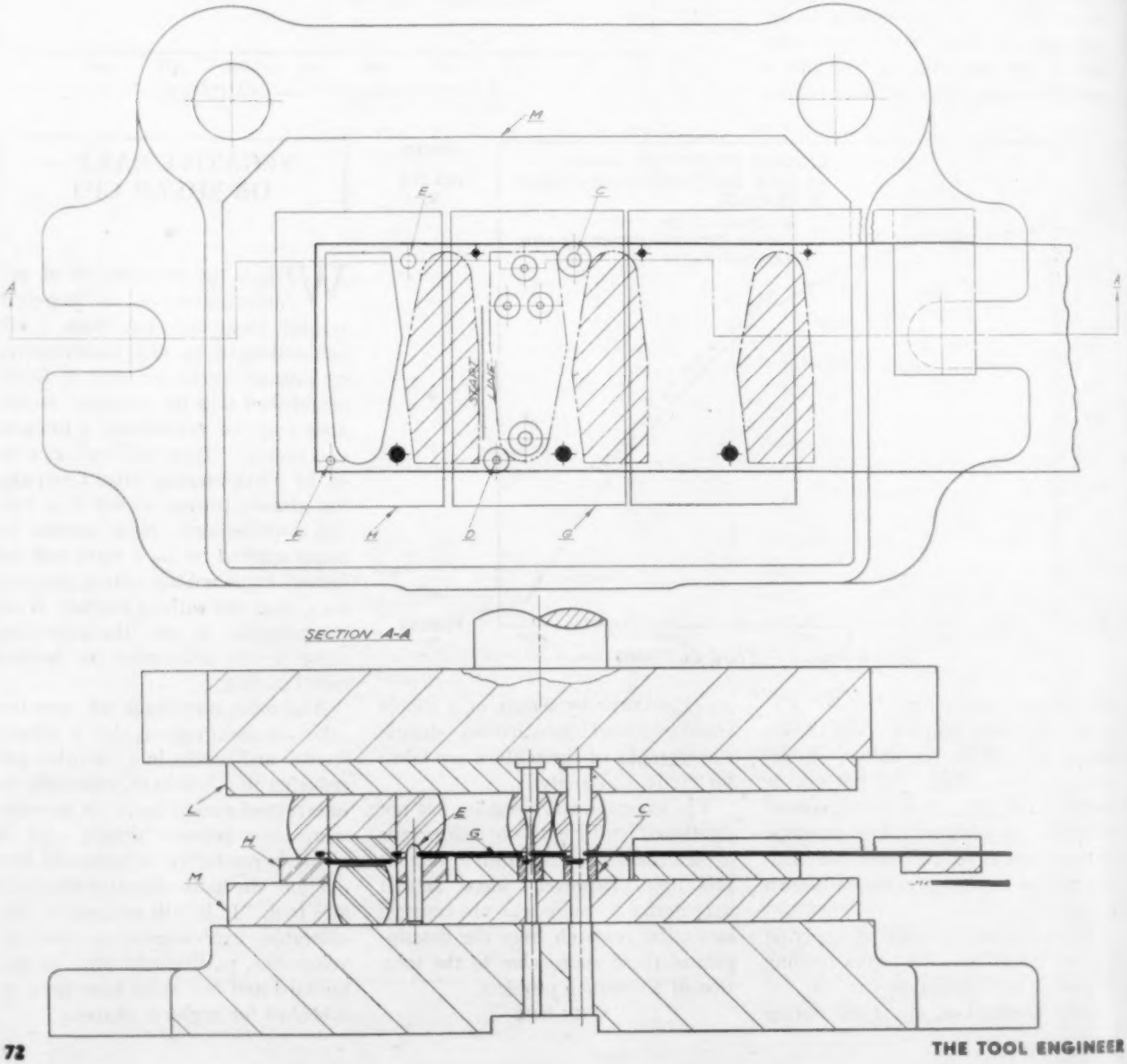
When the strip has been completed, it is reversed and the second pass is made. Since holes C and D are of different sizes, the pilot holes made at the first pass will not register for the second pass.

By placing the two stations on independent blocks G and H, fastened to plate A, regulation of scrap skeletons is simplified, and tool steel is saved by the use of die buttons in the mild-steel block G.

Blanking punch and die steels may be thin sections of tool steel, hardened and ground and riveted to mild-steel fillers; or the cutting edges may be flame hardened. This permits placing pilot pins E and F after hardening. Rubber strippers may be replaced by a spring-loaded stripper when greater pressures are required.

On short runs, plates L and M may be jig drilled to fit over dowels in a standard die shoe. In this case, clearance for slugs is provided by parallels placed between the plate M and the lower die shoe.

With flame-hardened cutting edges and rubber strippers, this die has made production runs on SAE 4130 stock, .093″ thick, as well as on aluminum alloys up to .125″ thick.



PRODUCTION

Streamlined Production

Tooling Up for 3000 Jobs a Month

IN ONE MONTH the Weatherhead Company of Cleveland accepts nearly 3000 orders for manufacture. Unit production per order ranges from five pieces to 15 million. The majority of these are for assemblies, that is, units consisting of more than one part. Added to long run orders and production of Weatherhead's regular line of valves and fittings, this means that as many as 10,000 jobs may be in active production at one time.

Production of between 40 and 45 million parts is a typical monthly output to satisfy assembly requirements.

Obviously, intensive production control is a first necessity to a satisfactory manufacturing operation of this nature. Equally important is close attention to production economy. Efficient methods must be established for various types of operations, and those methods must be adhered to carefully because the scheduling of activities of machines and departments on a precision basis is demanded.

Both production control and refinement of methods have been developed to a high degree by Weatherhead production engineers. Manufacturing schedules are largely made up from machine load charts which indicate the availability of basic equipment over the coming weeks and months.

Basic equipment is first and foremost the tremendous batteries of automatic screw machines. Multiple-spindle automatics and Brown & Sharpe single-spindle machines carry the greatest burden. Next as basic equipment comes a battery of Kingsbury automatic indexing machines. Special heads on these machines are equipped to drill, ream, countersink, tap and spotface. Six to 11 operations may be performed on the fixtures in use at the Weatherhead plant.

A third type of machine which is occasionally regarded as being in the basic equipment class is the Bodine multiple-spindle, automatic indexing machine. Its chief value is in controls which enable the operator to preset the number of spindle revolutions. This feature permits tapping to within a half thread of the bottom of blind holes.

Machine load is figured in hours per thousand parts. In determining complete operation time, production engineers refer to time-study recommendations which are usually based on 60 per cent of a machine's rated capacity.

When an order is accepted and scheduled for primary machining on basic equipment, the production engineering department generally has a choice of three or four methods or sequences of operations in completing the fabrication.

With numerous parts having similar appearance and some parts of identical shape being produced in two or three different materials, a tremendous responsibility falls upon the production expediter. However, his work is assisted by "paper" control, which in most plants is the subject of some complaint, being considered red tape. However, in view of the variety of production jobs handled regularly, it serves ably in relieving the expediter of makeshift systems for keeping track of production progress. Actually, the system is no more complicated than that employed in plants regularly producing a standard line. The only difference is that more forms of a given

Bodine multiple-spindle drills supplement a large screw machine department and a battery of Kingsbury machines as basic equipment. Control of spindle revolutions permits tapping to one-half thread of bottom.

Weatherhead photographs and drawings

SPECIAL FEATURE BY THE EDITORS

type are handled day by day in controlling production.

Paper work begins with the acceptance of an order. For the average 30-day production job, an order accepted in March is planned for June delivery. Materials therefore are requested for May delivery. This method of materials control has resulted in holding inventories down to from four to six weeks.

Well in advance of materials delivery, Production Engineering decides upon the manufacturing method and sequence. Based on its decision, details of the machine and tooling requirements are incorporated in operation sheets. Five preliminary copies are prepared, one of which is issued to the tool room, enabling that department to prepare for the job.

Upon receipt of the material, operating copies go out to the proper departments. The copy sent to the stockroom constitutes an order for the beginning of the job according to the schedule included.

Variety of Parts Imposes Handling Problem

WITH FEW EXCEPTIONS, handling of materials and parts in process is not systematized. The variety of jobs is such that this would be next to impossible. However, a complete monorail setup has been developed for transport of stock from the storeroom to the automatic screw machine department. Another monorail has been installed for handling parts through the heat-treating department. The great majority of parts in process are moved between departments on trucks which are called to the job.

Ninety-nine per cent of the parts and assemblies handled in the Weatherhead plant range in size from those of a few thousandths diameter and fractional-inch length to others a few inches in diameter and perhaps a foot long. For the most part, conventional tote boxes, loaded on skids, serve to transport them through departments.

Wherever in-line production is permitted, careful study is given the problems of balancing operations. Machine and manhours are concentrated on the "bottleneck" operations so that parts flow without interruption through the stations involving easier jobs.

Almost a day-in-and-day-out practice is the redesign of products to facilitate manufacture. Particular attention has been devoted to the problems of reducing integral units which are hard to machine to easily produced components. Brazing has been an important technique in this development.

Methods Engineering Streamlines Jobs

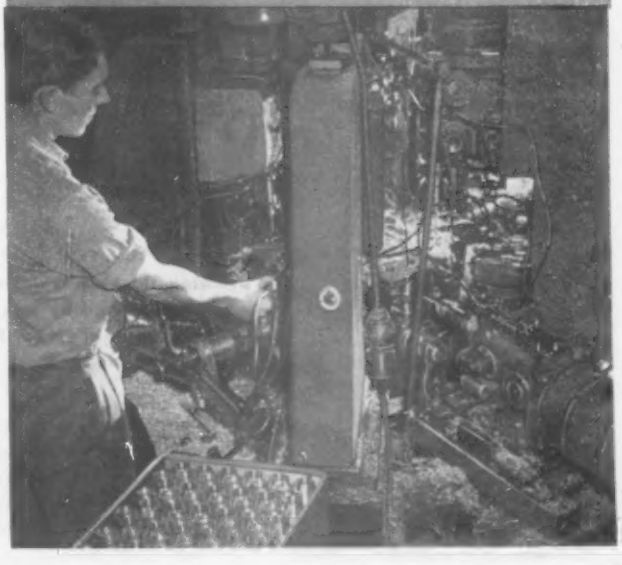
MORE AND MORE ATTENTION is being given methods engineering or research. This includes not only development of special machines which will streamline mass production operations, but also the alteration of an existing method to a more economical operation. Typical was the new machining method developed to improve a metal-to-metal contact of beveled surfaces. Fine finishes once specified made precise flats and accurately machined angles a necessity. In fact, the requirement was nearly impossible to meet. By machining the surfaces to angles compatible with the mass output required, and roughing the mating surfaces purposely with a burring tool, a better contact was produced in assembly. From a methods-engineering viewpoint, however, the main triumph was one of greatly increased production.

High-production machine output requires high-production testing equipment. Magnaflux installation shown above is used on aircraft parts inspection.

Where possible, materials handling is simplified with monorail.

Equipment shown here streamlines production in the heat-treat room.

Kingsbury automatic-indexing machines are part of basic equipment to which overall Weatherhead production is geared. Special heads provide for drilling, reaming, countersinking, tapping, spotfacing.



Streamlined Production

Ingenious Use of Special and Standard Machines Results in Efficient High Production

DRILL PRESS CONTROL

Drill press with cam-controlled spindle stroke and pneumatic actuation can be operated within seven machining cycles. Two spindle speeds and three feeds are available for combination.

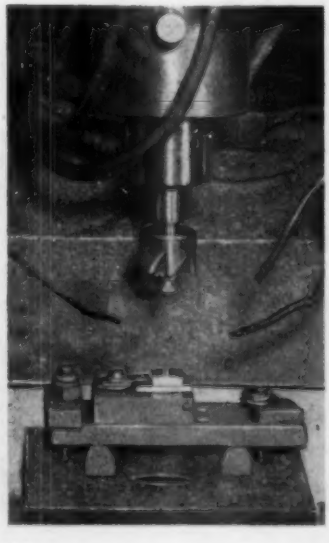
Where fairly coarse feeds are permissible, speed and accuracy in drilling small brass, Dural, and mild steel parts have been assured by application of a six-cycle drill press. The press is equipped with a cam-actuated stroke. A cam may be used which will obtain the maximum stroke distance of 4″, of which 3″ is considered available for a working stroke, allowing for work clearance and a safety factor. Cams provide accurate control of stroke depth, and to some extent provide the possibility of accelerating or decelerating feed within the total feed cycle which is controlled by the total speed of cam revolution as preset through the variable gear drive.

By combining variable speed gearing to obtain any of three stroke cycles with either of two spindle speeds, a selection of six feeds and speeds is available. At a spindle speed of 2000 rpm, total machining cycles of seven, five, and three seconds can be obtained by setting the feed gearing for fine, medium or coarse. At 1000 rpm spindle speed, stroke speeds are lowered to 14, 10, and six seconds.

With the three-second machining speed, floor to floor time of 5-½ seconds is possible.

One operation in which this machine is used requires the application of a combination hollow mill and forming tool with a drill. The purpose is to form a seat for a flared tube, to drill a 7/32″ hole, and to hollow mill for a ½″-20 thread. Used horizontally, such a tool would require a heavy flood of coolant, and then the possibility of chips jamming would be a constant danger. Applied on a vertical spindle, the chips are cleared by gravity.

Perfect timing of this equipment assures accurate feeds and speeds within the ranges of work to which it is applicable. Tool life is also increased, provided that the tool is suited to the feeds and speeds selected, and to the metal being machined. If these factors are compatible with the design of the tool, there is no opportunity for the operator to break or dull the tool through improper application.



Drawing shows machining job as performed by combination tool on a drill press with cam control.

Combination tool includes hollow mill, forming, and drilling tools. Drill press is one of a production battery, of which all are cam-controlled.

WELL-DESIGNED JIGS AID MASS PRODUCTION

Well-designed drill jigs permit maximum production of parts where accuracy and a large variety of operations are required. One jig is used to perform 10 separate operations, and a production of 15 pieces per hour is maintained. The use of stops on drill press tables is undoubtedly an aid to increased production in this instance, and it has probably effected an increase in tool life.

Operations include drilling a 5/16″ hole to ½″ depth; spot-facing and countersinking for a ¼″-20 thread hole; drilling and then tapping; drilling a 13 mm hole; facing; spot-facing and counterboring; serrating; tapping a 9/16″ -20 thread hole; and burring inside a 5/16″ hole.

Three surfaces of the drill jig are used in the course of operations for locating these jobs.

•

Another drill jig serves ably in manufacturing an aluminum end fitting for a hydraulic cylinder. With seven drill heads, a total of nine operations is performed on the one part. Two of the operations consist of drilling through the fitting from one end to the other. The section through which the hole is drilled is perpendicular to the axis of the cylinder. Upon completion, a pin is inserted through the hole, so as to extend on both sides. The main body is laid in a V-block, and the part is passed beneath indicators which bear on each end of the pin. In checking for run out a total indicator reading of .002″ is permitted.

Use of stops on drill-press table is undoubtedly an aid to increased production, and through assuring accurate work positioning, can increase tool life.

Finish-grinding hydraulic-cylinder piston rods is performed on a centerless-grinding machine.

GRINDING HYDRAULIC PISTON RODS

Actuating piston rods for hydraulic cylinder assemblies must be finely finished, but even more important, they must be true. Specifications demand that those produced by Weatherhead be concentric within .003″. For a 10″ rod, diameter is specified as .621″ to .6215″. This rod is fabricated from SAE 4140 or NE 8630, and is heat treated to a tensile strength of 125,000 to 145,000 psi.

Received from the heat-treating department, ready for final finishing, the forged rods are warped and distorted—crooked as the proverbial "dog's hind leg." Previous to the present combination of grinding applications, attempts were made to straighten the parts on an arbor press, as a preliminary to finishing by centerless grinding. With this method, output ranged from 20 to 30 daily.

By substituting a rough-grinding operation for the use of the arbor press, production has been increased to 40 pieces per hour—nearly 1300 per cent more. A modified plunge cut leaves approximately .010″ of stock to be removed by centerless grinding. Finished tolerances are plus or minus .0005″.

The rough-grinding job is simple in setup and operation, there being no requirement beyond that of establishing concentricity. The part is mounted between centers, and ground with respect to those centers. In both grinding operations, stock is removed only to a set distance from a forward eye at one end, requiring the use of stops on the centerless grinder to prevent the part from passing entirely through.

Streamlined Production

Streamlined Production

HAND MILLER WITH INDEXING FIXTURE

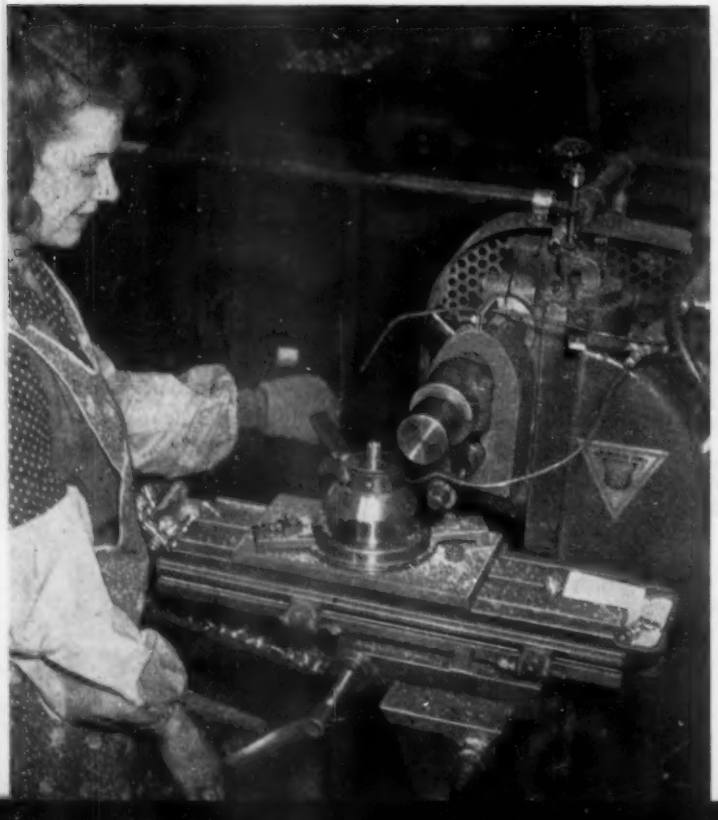
A quick-attachable hose fitting for hydraulic aircraft installations which Weatherhead designed has both functional and production advantages over conventional types. Since the fitting replaces the swaged-end variety, production problems have been reduced in that no special tools are required for assembly. Tolerances on the finished part need not be as close as formerly because of the expanding-collet feature.

The fitting consists of a threaded, tapered, steel insert within a Dural body and hex nut. Integral with the hex nut is a collet which is slotted to permit expansion. In machining this component from round, a manually operated clamping and indexing fixture permits straddle milling the hex nut and slotting the collet. One fixture setup, with interchangeable jaws is used for both operations. Two tool setups consist of mounting a single saw for slotting and a pair of saws for straddle milling the hex.

After setting the part upright in the open jaws of the fixture, jaws are closed by downward movement of a handle to a horizontal position. The fixture is located on the table of a "handmill", beneath the horizontal arbor. Following straddle-milling operations, which are completed in three turns of the indexing fixture, the sawing cutter is mounted to slot the part.

The clamping lever in horizontal position, is used to index the fixture to positive stops. A production of 4000 parts from each machine in eight hours is possible.

Rapid-index (dual purpose) fixture speeds production on slotting quick-attaching hose fitting. Output of 4000 parts on hand miller in eight hours is possible.



Inserting quick-attaching fitting in milling fixture.

BRAZING LOWERS COSTS

Breaking integral units, which are hard to manufacture, into assemblies of easily produced components, has been greatly facilitated by the increased application of brazing. Since 1936, Weatherhead production engineers have applied this process wherever feasible.

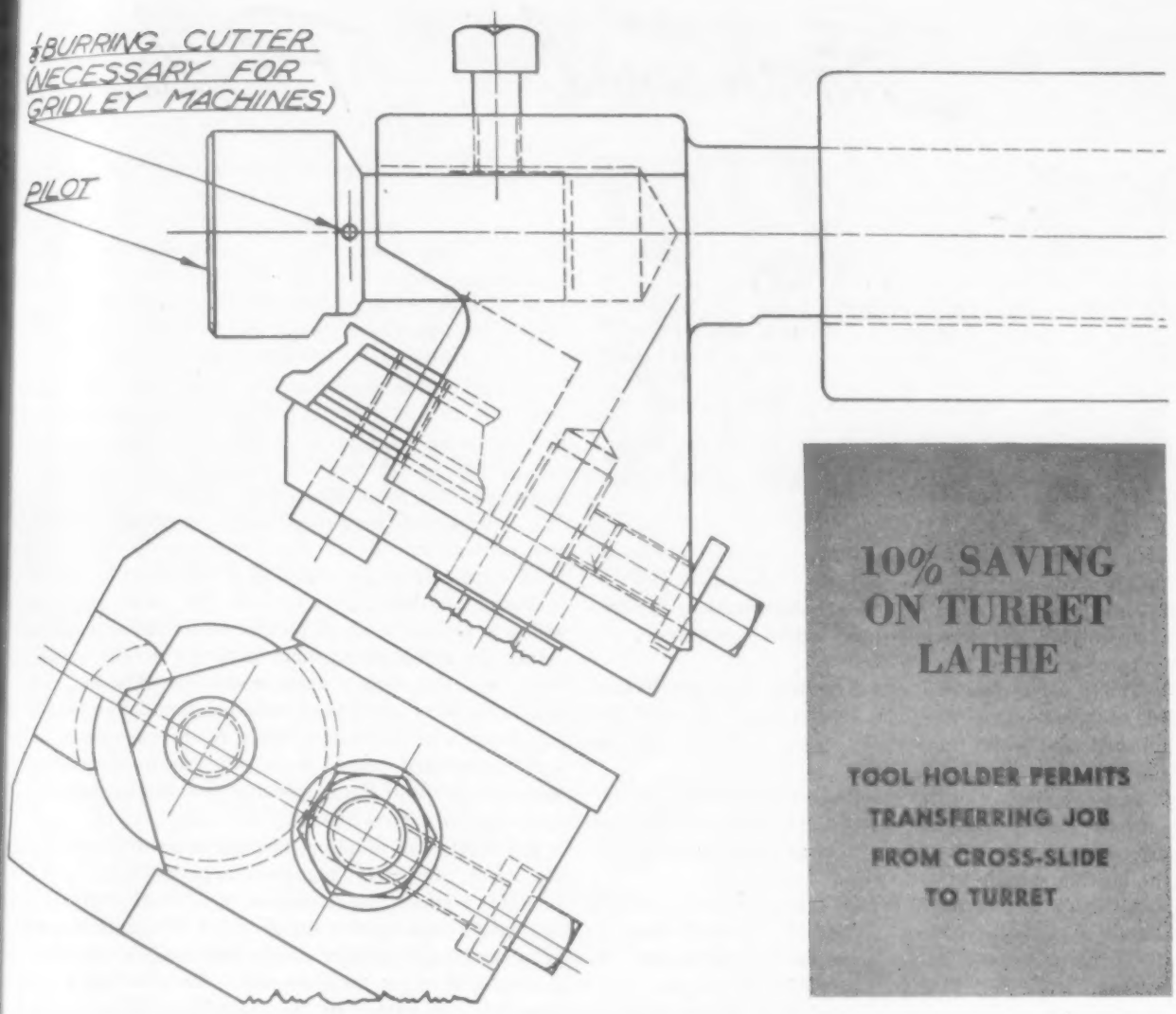
A typical example of improved production economy through the use of brazing is shown in the present method of producing refrigeration dryer assemblies. These units consist roughly of cylinders with fittings at each end. They are required to be absolutely airtight.

A typical end fitting includes a hex nut secured to a dome or bell-end for the cylinder. When specified as an integral unit, the hex nut was produced by a tedious milling operation. Brazing the nut to the bell is a simple operation, permitting simple mass manufacturing of the two units.

The entire cylinder assembly is performed by press fitting such parts together, with the brazing rings set in place before the press fit is made. This not only assists in handling the parts for introduction to the brazing furnace, but it also assures accurate and secure placement of the brazing ring.

Another application of brazing which has lowered production costs is the fabrication of a hose nipple fitting. Previously, nipple and hex nut were manufactured as integral units. Now a tube section is brazed to a hex nut, the tube end is beaded, and the part is complete. Simple components are easily produced.

One of the most complicated units, when machined as an integral part, was broken down into easily-manufactured components. This was an angle valve. Again, press fits were made of the parts to the valve body, with copper rings seated before the primary assembly was made.



10% SAVING ON TURRET LATHE

TOOL HOLDER PERMITS TRANSFERRING JOB FROM CROSS-SLIDE TO TURRET

Attention to details of individual machining operations has contributed much to overall production economy achieved by Weatherhead production engineers.

An excellent example of a machining saving is that of removing a forming operation from the cross-slide of a turret lathe and putting it on the turret itself. The particular operation consists of forming a flared-tube seat on a hydraulic fitting. More ingenuity in the design of the tool holder was required than in any other detail of the accomplishment.

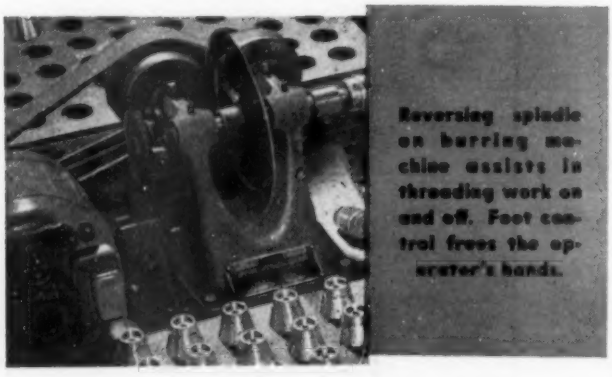
A 10 per cent production saving is effected by this well-designed, piloted forming tool. It may well be put in any book of turret lathe setups. The use of the pilot to hold the tool true has wide possibilities for all types of forming.

"IN-LINE" PRODUCTION ON BURRING JOBS

In performing burring and inspection operations on assemblies of average complexity, such as bomb fuses, production management can do much to capitalize on the savings effected by fabrication methods. On the other hand, it can invalidate much of the economy previously attained by not balancing finishing operations completely. Weatherhead engineers have broken down the burring and inspection operations so that full production value is realized from manhours previously invested. In themselves, they furnish good examples of balanced operations through intelligent distribution of manhours and clever tooling.

In burring, internal surfaces are finished with pencil-shaped wheels, or small-diameter spindles covered with sand paper. Usually, such spindles are connected directly to small electric motors. In burring external surfaces, the part is chucked and revolved beneath emery cloth.

One external burring job on the tapered surface of the fuse body employs a quick-reversing spindle which is threaded to receive the base of the body. Holding the emery cloth in his right hand, the operator picks up the part



Reversing spindle on burring machine assists in threading work on and off. Foot control frees the operator's hands.

with the same hand, holds it to the revolving spindle so that it is run up tight, takes one end of the emery strip in his left hand, and then with both hands, holds it against the revolving part, which is finish-burred in approximately two seconds.

The operator then reaches for the next part, as described, and at the same time, uses his free hand to hold the finished part while the spindle reverses and the part is run off.

Reversing action of the spindle is obtained by a pedal-actuated device which alternates the bearing of friction drives against opposite sides of a large wheel mounted on the burring spindle.

A small-diameter metal cutter is used to burr a blind slot on a small component. The part must advance to the cutter accurately, and to a pre-determined depth. A holding fixture guides the part by means of two pins sliding within holes in a block located beneath the cutter. Bringing the holding fixture up against the block provides a positive stop to the advance of the part.

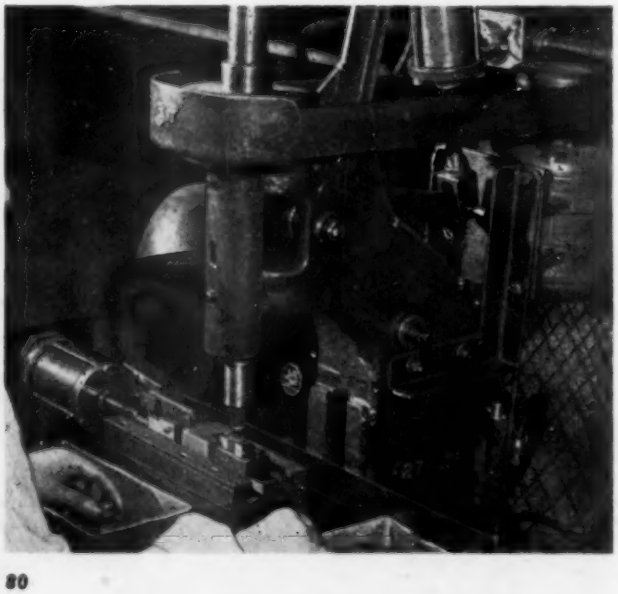
Inspection of fuse parts has been improved almost 100 per cent by rearrangement of operations. Previously the job was divided into operations on three tables, and inspection was impeded somewhat by the requirement of moving parts from one table to another. The overall job, which is constituted of numerous short cycle operations, was thus divided arbitrarily by the parts handling problem, where no natural division of labor actually existed.

By performing the job at one long table, a smoother flow of work was possible. At the same time, the single line permitted more accurate time and motion study of the various operations. A consequent improvement in balancing the manpower investment resulted. Where jobs had been divided roughly to one operation per person, the majority of inspectors engaged in shorter cycle work were able to get ahead of a "bottleneck" minority.

Among finishing operations on the fuse body is one which is typical of small production improvements, indicating the attention to manufacturing details which is important to a plant in mass production. The job, as it is now being done, consists of striking a number on the body. A gear reducer has been adapted to this operation. The part, a truncated conical shape, is fed between an inverted beveled roller and the numbering punches by means of a revolving horizontal plate.

The method of handling this job is unconventional but little more than a common-sense application of a piece of available equipment. However, well worth noting is the fact that by taking the job off a 2-5/8″ multiple-spindle automatic machine, total production time on the machine was reduced two to three seconds. Because this is an accountable percentage of the complete production cycle, this change permitted scheduling more production for this particular class of basic equipment.

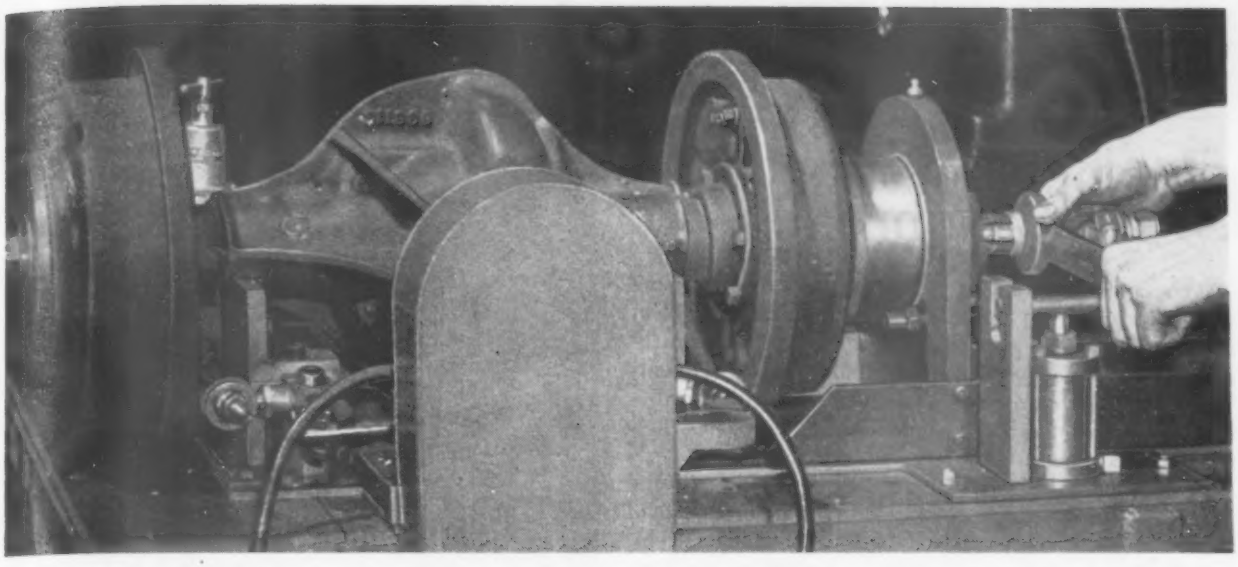
PNEUMATIC CONTROLS ON MACHINE AND CLAMP ACTUATION



From actuating simple clamping devices to controlling cycles and furnishing power for more complicated fabricating mechanisms, pneumatic power has been applied by Weatherhead production engineers with good effect. In assembling firing pins to booster caps, a peening action is required to flatten the pin over the disc around the perimeter of the hole. Pins are placed in a pneumatic clamp, and discs laid on top. Pneumatic pressure is applied which causes the clamp to slide under a revolving spindle. The spindle's descent, under pneumatic force, is so synchronized with the advance of the work that a small roller tool performs the required peening action.

More dramatic is the use of a truck differential to obtain torque control in assembling hose-attachment fittings. Use of the differential permits a steady application of power, without need for an expensive slip-clutch arrangement. A conventional braking mechanism on the axle, on

Left: **Pneumatic control actuates spindle stroke and the clamping action and movement of vise on assembly job.**



Truck differential provides torque control for hose fitting assembly. Pneumatic cylinders eliminate manual action.

the opposite side of the differential from the chuck, assists in governing torque applied in tightening the part.

Originally, the externally threaded collet of the fitting was run into the hose end with the spindle revolving under brake pressure. With the collet fully tightened, the pressure was sufficient to stop the spindle. Then the wrench was placed on a hex nut of the fitting assembly and the threaded parts of the fitting were run together with brake pressure released. This expanded the collet within the hose end.

Improved pneumatic controls permit performing the entire operation without manual adjustment. Under predetermined braking pressure the fitting is run into the hose, and the nut which expands the collet is tightened. The free end of the wrench tightening the nut is held against the piston extending from a small pneumatic cylinder. When pressure is sufficient to force the piston down $\frac{3}{8}$", power for the entire mechanism is automatically braked.

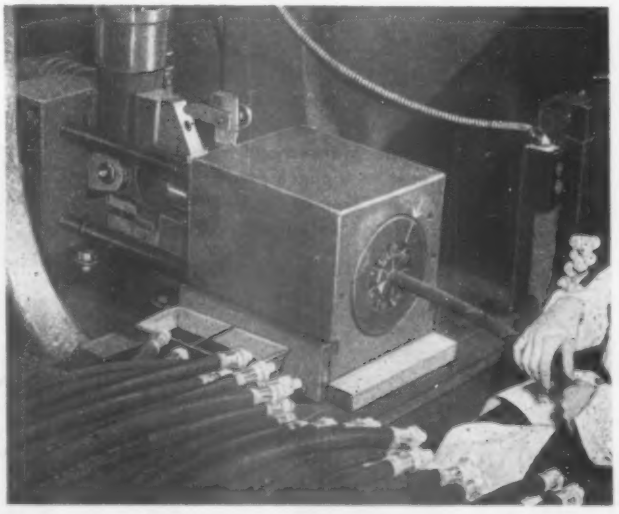
In a sense, pneumatic countercontrols are used to establish the nicety of force application which is frequently an obstacle to development of complete pneumatically operated fixtures.

In manufacturing fuses, spring assembly is an important job. If not performed efficiently, it can be time-consuming. Quick-acting, limited-stroke, pneumatic-powered pistons serve as spring compression tools.

CRIMPING TUBE FITTINGS ONTO HOSE ENDS

Crimping tube ends of hose fittings onto hose ends has been speeded by the application of a fixture incorporating the principles of certain pneumatic chucking devices. Fingers around the inner diameter of a truncated cone crimp the tube end when advanced. Fingers are caused to advance by a cam revolving against an actuating piston. The cam turns on a shaft which is powered through a pedal-operated clutching mechanism. On small, light-gauge brass and dural fittings, power from small electric motors is sufficient.

For heavy steel fittings, a punch press supplies the power to the actuating mechanism which advances eight fingers within the crimping fixture. A lever arrangement between the piston and the press ram transmits the power. The force now exerted originally required the effort of three men using a 10-foot bar for a lever. Obviously, accurate control of force was impossible. Since hose end fittings must stand a working pressure ranging from 10,000 to 30,000 psi, considerable, but accurately controlled, force must be exerted.



Punch press actuates crimping jaws in assembling heavy tube fittings to hose ends. Jaws are interchangeable.

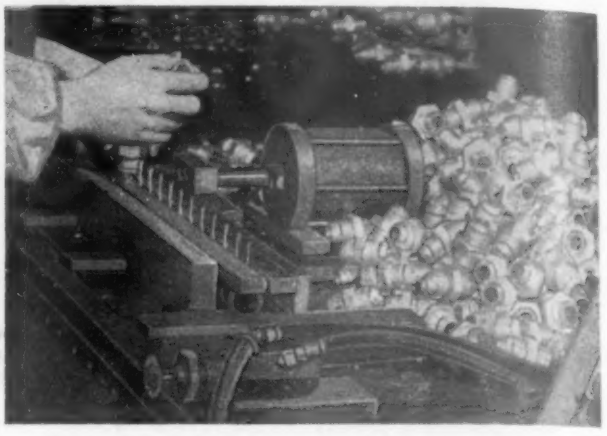
HANDLING MATERIALS FOR ANODIZING

Thousands of varied parts pass through the anodizing tanks in a single day, imposing an extraordinary problem of materials handling in view of the high production required. They are brought to the anodizing department, segregated only by tote boxes and identified with expediting tags. Two methods of handling the various lots through the same setup have been devised.

Fittings and other parts having diameters ranging from 1/16" to 1-½" are quickly racked with the aid of an ingeniously designed hanger and racking fixture. Hangers consist of a U-section channel, with 20 prongs projecting from each side. When the channel sides are pinched together, under pneumatic pressure, the prongs meet and parts are slipped over them. Pressure released, the prongs spring apart with sufficiently sustained force to hold the parts securely. From hooks formed at one end of the hanger, parts are easily suspended in the anodizing solution.

A simple pneumatic clamping fixture, consisting of two parallel jaws, holds the hanger in position for loading parts. Parts from the same lots are slipped over the mating prongs, and the jaws are opened.

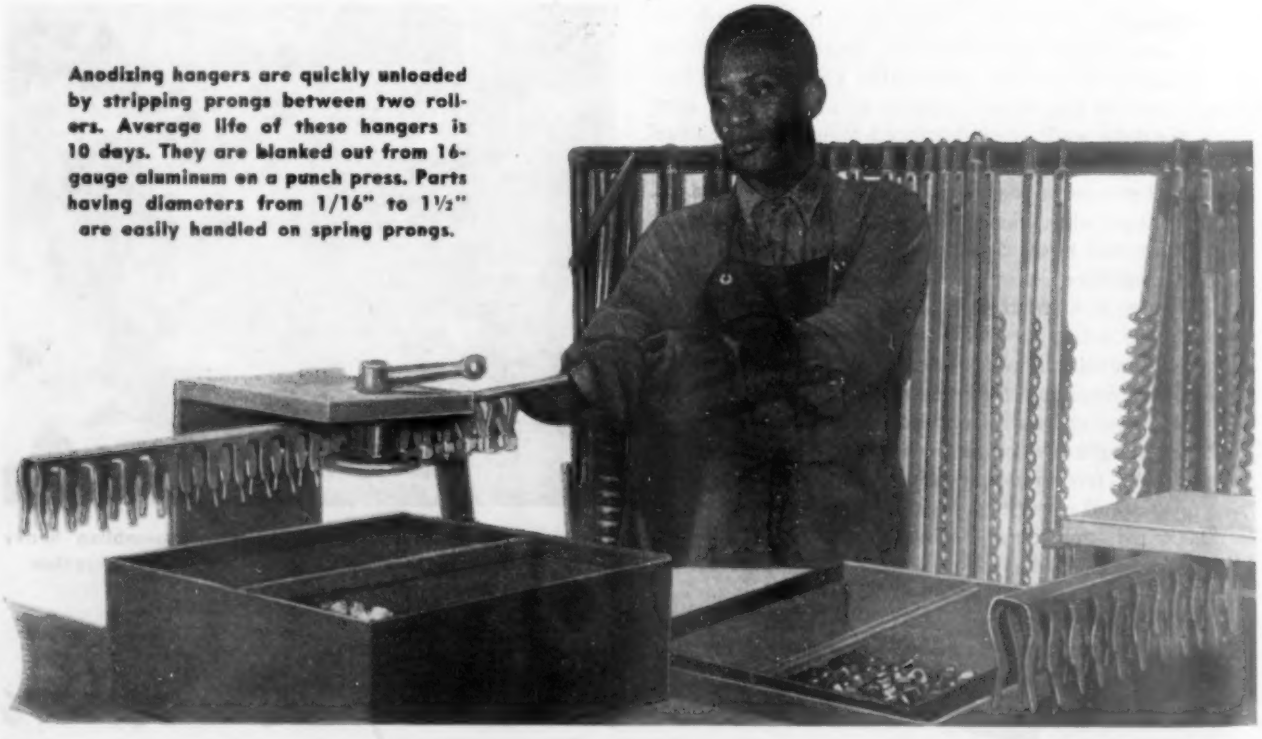
Parts are unloaded by forcing the rack between rollers or wheels which compress the prongs just above the point of entrance into the part. The anodized parts drop from the compressed prongs into perforated trays which are placed over dryers. Racks are blanked out as needed from 16-gauge aluminum on a punch press. Flexible enough to accept a wide range of shapes and sizes, their average life is a week to 10 days.



Weatherhead's universal anodizing hanger is loaded in pneumatically-operated fixture. This device simplifies materials handling in a busy department.

However, there is a large number of extremely small parts which can be accommodated, but the operation is not economical. Loading these parts on hangers would require on the average 2-½ hours per thousand parts. By loading them in baskets for anodizing, about 10 per cent of the parts will not anodize properly. However, these deficient parts are quickly identified by their light color, and they can be culled rapidly from the lot by spreading the entire basketfull on a table. With this method, production time on loading and unloading completely anodized parts has been lowered drastically to 15 minutes per thousand.

THE END



Anodizing hangers are quickly unloaded by stripping prongs between two rollers. Average life of these hangers is 10 days. They are blanked out from 16-gauge aluminum on a punch press. Parts having diameters from 1/16" to 1½" are easily handled on spring prongs.

ELECTRONIC
Adjustable Speed Drives

V-DAY TOOLING

• At the last annual meeting of the American Society of Tool Engineers, details of electronic motor control and its application to machine tools were discussed. This material, presented on pages 83-90, brings up to date a subject which The Tool Engineer magazine introduced in its May, 1943, issue.

• On page 91 appears "Broaching Fundamentals and Application." With last month's articles on boring and flycut milling, this completes the publication of papers presented at the two-day meeting in Philadelphia.

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& MANUFACTURING COMPANY

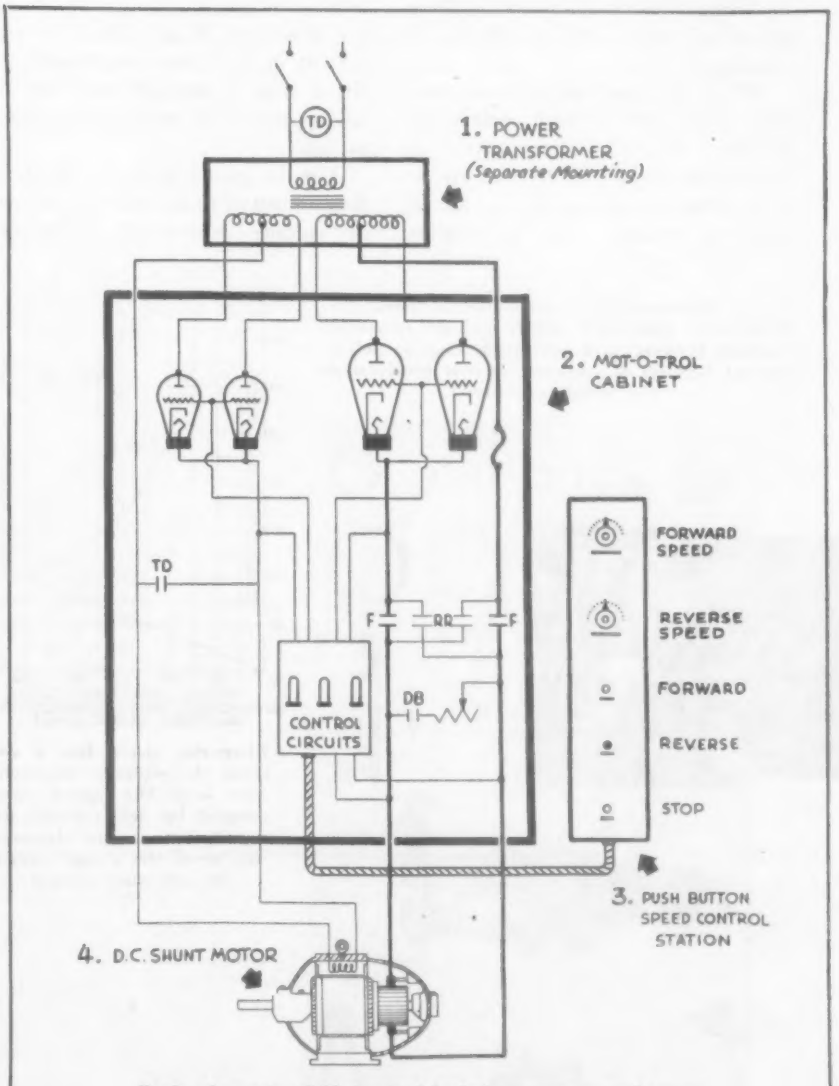
BOTH THE BUILDERS and users of machine tools are wondering what electronic equipment the electrical industry has to offer. The electronic adjustable-speed drive is one of the most promising. Various machine-tool builders are experimenting with it and some are using it already as standard equipment.

Many types of machine tools, especially those used for milling, boring, and grinding, require a wide speed-range adjustment for both the spindle and feed drives. It is also desirable to be able to adjust speeds in small steps without stopping the machine and to have the speeds remain nearly constant with variations in load. At present these features are usually obtained by using a constant-speed alternating-current motor and a gear-changing mechanism or a hydraulic device. The electronic drive which we call a Mot-o-trol provides another means.

The basic idea of using grid-controlled electronic tubes to convert the standard a-c power taken from the power lines to d-c power and use the d-c adjustable voltage which is obtained to cause a d-c motor to operate over a speed range is, of course, old. However, the simpler forms used had poor voltage regulation and, as a result, the motor could be operated only over a very limited range in speed and had poor speed regulation with changes of load. Now the unit has been developed to a point where additional control tubes have been added to compensate for the poor inherent voltage regulation, so that it has become a useful and flexible drive for machine tools.

The electronic system consists of a single-phase or polyphase grid-controlled Thyratron rectifier. The d-c voltage output of the Thyratron is applied to a regular shunt-wound d-c motor and can be varied from zero to rated motor voltage for d-c armature control. A smaller Thyratron tube provides direct current for the motor field. Speeds below the base or full-field speed of the motor are obtained by variation of armature voltage. To provide higher speeds, the field is weakened by reducing the field voltage. In short, the adjustable-speed drive accomplishes with the electronic rectifier the same function as the motor-generator set in the conventional adjustable-voltage system, that is, it obtains a wide speed range from a d-c motor starting with a-c power.

A complete a-c electronic motor control drive is composed of four



Basic elements of Mot-o-trol include power transformer, control cabinet, d-c motor, and push button station.

Ease of obtaining wide range of speed adjustment with constant pulling power and constant speed under varying loads makes electronic motor control a factor in today's machine tool engineering

principal pieces of apparatus:

(1) The a-c power transformer which has the proper number of phase windings and correct secondary voltage for supplying the rectifier tubes

(2) The electronic-control cabinet proper including all necessary tubes, resistors, relays, capacitors, and similar equipment

(3) The operator's control station with pushbuttons and speed adjusting dials

(4) The d-c motor itself.

The power transformer and electronic-control units together are considered as the power supply. The number of rectified phases depends upon the most economical arrangement of the available Thyratron tubes required to handle the motor rating. On Mot-o-trols of 2 hp rating and smaller, single-phase full-wave rectification is usually employed. For larger ones, some of the several polyphase rectifier systems, including two-phase full-wave, three-phase half-wave, and six-phase are employed.

All of the speed-adjustment functions (exclusive of field weakening) whether manual or automatic, as well as the current limitation, are accomplished by adjusting the motor-armature voltage. This is obtained by advancing or delaying the point on the a-c voltage wave at which the rectifier tubes fire, thus permitting only a part of each a-c voltage wave to be rectified. This firing point can be controlled in several ways. In the Mot-o-trol, an a-c voltage from a small grid transformer is applied to the Thyratron grid. This voltage, through the proper adjustment of capacitor and resistor components in the grid transformer secondary circuit, lags the anode (or line) voltage by 90 degrees. In addition, a variable negative d-c voltage component is applied to the same grid. When the d-c voltage component is zero, the maximum advance in firing angle is obtained, and therefore the maximum voltage is supplied to the motor armature. When the d-c component is increased negatively, the firing angle is delayed until the voltage applied to the armature is reduced to zero.

The a-c grid voltage is chosen 90 degrees out of phase with the a-c supply voltage because this arrangement permits maximum continuous control of the Thyratron to the range from maximum advance of the firing point to cut-off.

The range of speed adjustment by motor-field control is at constant horsepower, which means that the torque or pulling power of the drive is highest at the base speed of the motor and decreases as the motor speed increases.

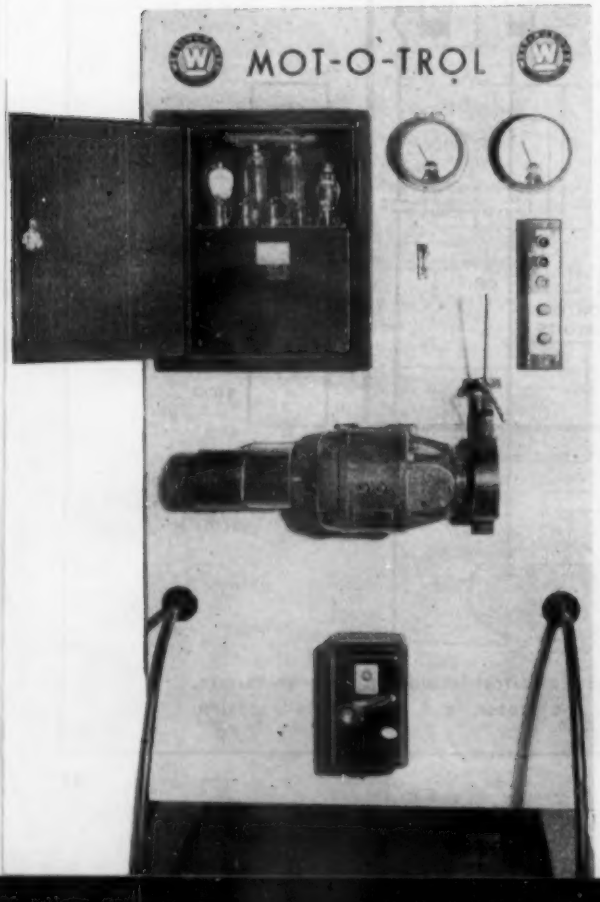
IMPORTANT CHARACTERISTICS

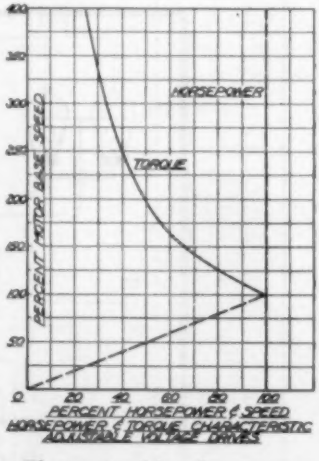
The range in speed by armature control is constant torque in nature, which means that the torque from base speed down to the minimum speed is the same, and the horsepower decreases in proportion to the decrease in speed.

It is important to remember these characteristics because they match the requirements of the drives on some machine tools, but not on others. For instance, the spindle drive on a machine tool is typically one which approaches constant horsepower over its range because it is usually assumed that the amount of metal removed per minute is fairly constant, regardless of the size of the cutting tool. When large-diameter cutting tools, such as large milling cutters, are used, speeds are kept low and very high torques are required. Using a milling machine as an example, the low-speed range is used for large cutters and the high-speed range for small cutters. Since the horsepower required is nearly constant, the torque required at low speed is higher than normally would be available unless the adjustable speed motor size were increased. Therefore, care must be used when applying the electronic drive to a spindle drive.

However, on a feed drive, the load is much nearer to one requiring constant torque, since a large proportion of the power requirement is merely the overcoming of friction and moving the feed mechanism at the desired rate. It is true that there is a tool reaction and that this reaction tends to be more when making heavy cuts at low speed, but this usually represents a relatively small portion of the total load, and a drive that has a portion of its range obtained by field control will develop ample

Below: **Demonstration unit shows standard one-horsepower Mot-o-trol, which includes reversing, dynamic braking, and field weakening, as well as normal features of constant current acceleration and speed regulation.**





Electronic drive has a constant horsepower characteristic over the speed range covered by field control, and a constant torque characteristic over the range covered by armature control.

Westinghouse photo and drawings

torque at low speed without making the equipment oversize.

The amount of range that can be obtained is at least 20 to 1 by armature-voltage control and 4 to 1 by motor-field control, giving a total range of 80 to 1. In some applications this range may be extended to give an overall range of approximately 100 to 1. The maximum amount of speed range depends upon the application and how important it is to have a smooth speed in low range.

Speed regulation is more than ample for most applications, but even better results can be obtained with slight additions to the equipment.

In comparing this equipment to that previously used, especially when comparing it to gear-changing mechanisms, the following advantages can be listed:

1. An infinite number of speeds in the speed range are available instead of just a certain number as determined by the number of gear changes supplied.

2. These changes in speed can be made at any time by a small potentiometer, located convenient to the operator's position, without stopping the machine. On a gear-change mechanism it is usually necessary to stop the machine and to require a considerable amount of time and effort by the operator, besides making a mark on the work at the time the tool is stopped. This feature tends to increase production since it is easy for the operator to select the correct speed and he can also easily increase or decrease the speed as the conditions on the cutting tool change.

3. This type of equipment is ideally suited in setting up an automatic sequence of operation where it is necessary to frequently change the feed speed as the sequence of operation changes or else one in which it is desirable to automatically regulate the feed speed to maintain a given load on the cutter motor or some other special operating condition.

The electronic equipment can be replaced by a standard d-c motor and a motor-generator set to supply power and it is interesting to compare the advantages of each type. The simplest form of motor-generator set drive is probably somewhat cheaper especially in sizes from 5 hp and up, but does not have the equivalent speed regulation with change in load. The simplified set drive does not have as wide a speed range.

When the motor-generator set type of drive is supplied with sufficient equipment to increase its range and give a comparable speed regulation to the Mot-o-trol, then it usually becomes more expensive. Also, a motor-generator with three or more rotating units is needed, which usually requires more space, or at least is of such a shape that it is more difficult to mount than the electronic equipment.

The speed-adjusting rheostat for the Mot-o-trol is approximately the size of a push button and can be mounted in the same station, but the rheostat for the motor-generator set type of drive is too large for this type of mounting.

On a machine tool requiring a high degree of flexibility, a wide range of speed quickly and accurately adjusted, or an automatic cycle of operation, the Mot-o-trol is ideally suited and is becoming very useful in the machine-tool industry. THE END

OPERATING FEATURES OF THE ELECTRONICALLY CONTROLLED ADJUSTABLE SPEED DRIVE

STARTING:

The motor is always started with full field regardless of the setting of the speed-control potentiometer. If the desired motor speed is above the basic speed (achieved by weakening the field), that portion of the control that weakens the field does not become effective until the motor reaches base speed. To start the motor with weakened field would result in heavy armature currents.

CURRENT LIMITATION:

Fast, smooth acceleration is automatically obtained through an adjustable current-limiting control tube, which controls the negative d-c grid component of the rectifier tubes when a preset armature current is reached. Thus, the voltage output of the rectifier tubes is always such that the preset current limit is not exceeded. This limitation provides smooth operation of the driven machine by eliminating shock loads at starting and by giving a definite maximum torque during the accelerating period.

DYNAMIC BRAKING:

The motor is quickly stopped by means of a dynamic-braking resistor inserted across the motor armature. This is done by closing the back contacts on the motor armature contactor when the motor armature contacts are opened. The amount of dynamic-braking resistance is adjustable to control the rate of dynamic braking.

MANUAL SPEED ADJUSTMENT:

Manual speed adjustment is obtained by means of a small potentiometer. Changing this resistance alters the negative d-c component to the Thyratron grids and thereby varies the rectifier voltage to the motor armature from maximum to cut-off. The control can be preset for any desired speed, or the speed can be adjusted while the motor is running. Practically an infinite number of steps are available to provide adjustment over the speed range.

AUTOMATIC SPEED REGULATING:

Through other small control tubes and circuits the negative d-c voltage component on the rectifier-tube grids is increased or decreased automatically as the motor speed changes from the preselected speed in much the same manner as described for manual adjustment. The entire system is so balanced that the rectifier tubes furnish an output voltage to the motor armature at the correct value to maintain the preset speed under conditions of varying loads.

REVERSING AND INCHING:

Reversing contactors can be included in the equipment without increasing the size of the control cabinet. Proper relays for inch-forward or inch-reverse service can also be provided and suitable push buttons added to the control station. Inching or reversing can be done at any preset speeds within the speed range of the unit, or, if preferred, it can be done at one fixed speed. No speed control dial for inching speed need be used.

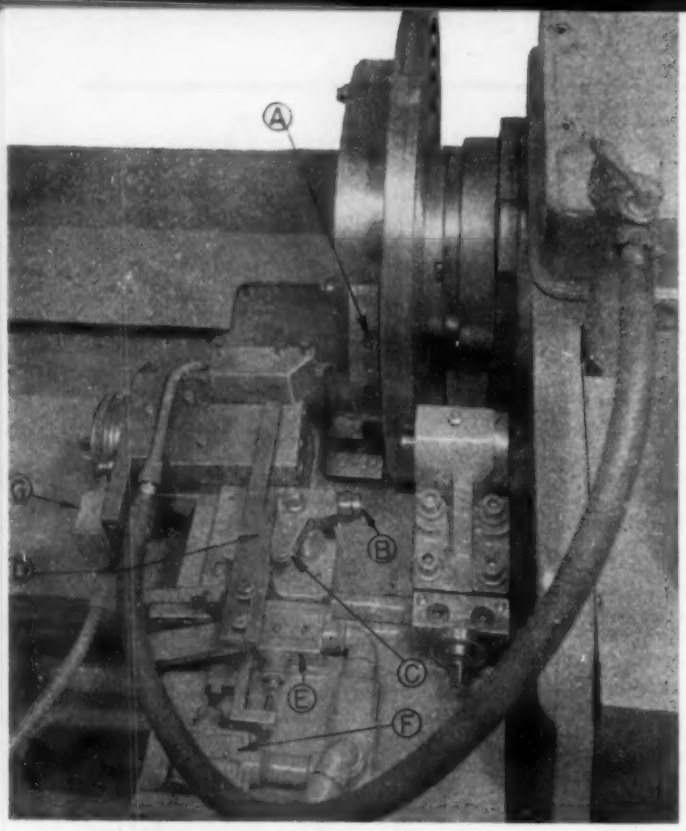
OVERLOADS:

To guard against too great an overload on the tubes and also to obtain desirable accelerating torque adjustment, the current-limiting device is standard on all units. The motor current is limited by proper control of the Thyratron grids. The range of current adjustment is from less than the full-load current to 200 per cent of full load current. On standard drives, this is set for a maximum of 200 per cent of rated motor current. In other words, it provides a starting torque of 200 per cent and a pull-out torque of 150 or 160 per cent. Aside from the protective feature, this current-limiting device permits adjustment of the maximum starting torque of the motor. The machine and its accessories are protected by the lessened starting-shock load and smoother overall operation.

In addition to this overload protective feature, the standard Mot-o-trol is equipped with overload and low-voltage protection, plus the inclusion of fuses in the armature circuit.

APPLICATION:

The proper application of the electronic drive is no more complicated than the application of an ordinary d-c motor where adjustable armature and field voltages are used. The anode power transformers and electronic-control cabinet can be considered as the source of adjustable-voltage d-c power for the shunt-wound d-c motor and should not be considered as complicating the actual application.



Three Applications of Electronic Drive to Lathes and Milling Machines

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FIGURE 1.

For machining a spiral groove, production engineers selected an automatic lathe with electronic drive. Cam mounted on back of face plate guides rear tool slide. Electronic control provides constant surface speed at the tool, and rapid return.

Sundstrand photos

48% Production Advantage

USING the electronic motor drive, a special lathe application has been made for machining a spiral groove in the end plates of a cartridge reel. The groove is 0.065" wide and 0.070" deep.

Two lathes were selected for the operation, one for the right hand spiral and one for the left. A face plate, mounted on the spindle nose, holds the work. On the back of the face plate is a master cam with a spiral track. A special rear tool slide moves centerward by means of a roller in the track.

Because of the thinness of the part, odd shape of the groove and limited size of the tool, a series of shallow cuts are required. A ratchet type "in feed" device advances the tool in increments from 1 to 7 thousandths during the return stroke. An adjustable dog, attached to the ratchet mechanism, can be set to trip a limit switch when the desired depth is reached.

Tool relief is necessitated by the shape of the groove and the tool. Therefore, at the end of the cutting stroke the tool is retracted approximately 1/8" by dog "A" engaging roller "B" as shown in Figure 1. During the return stroke the tool is advanced, and at the end of the return stroke, roller "C" is engaged by cam surface "D" which positions the tool for another cut. A simple planer type circuit provides limit switch control of the direction of travel and stops the machine.

For maximum production, the spindle speed in the forward direction should be adjustable in a two to one range to provide constant surface speed at the tool. Return speed should be as high as possible to reduce nonproductive time. Another qualification for this drive is fast acceleration. The a-c adjustable speed motor selected was rated 3 hp at 1150 rpm, with armature control from 575 to 1150 rpm and field control from 1150 to 2300 rpm.

Since the load produced by the tool in the cut is light, the total load on the drive is practically constant torque caused by machine friction. For this reason, armature control which is constant torque and has straight line speed response is ideally suited for the forward speed of the machine. The forward speed is controlled by a 4" potentiometer rotated by a gear located at "B" in Figure 2. The gear is driven by rack "A" which is fastened to the tool slide. The pinion at "B" and rack "A" are designed to rotate the potentiometer through 300° which automatically increases the speed of the drive motor from 575 rpm to 1150 rpm as the tool moves forward.

In reverse, the speed is controlled by a separate potentiometer which is manually adjustable from 575 to 2300 rpm. The reverse speed is then set to give the best results, in this case 1750 rpm.

Production for the two machines was 10 pieces per hour, and both machines, required only one unskilled operator. The temperature rise was within the motor rating, a feature of current limit control. These special lathes driven by the electronically controlled, adjustable speed motors increased the output per operator 567 per cent as compared to an original tool room setup. Compared with a 2 to 1 ratio two speed drive, production was increased 67 per cent. The machines complete with variable speed drives cost 10 per cent more than if they had been equipped with 3 to 1 ratio two speed drives, but a production advantage of 48 per cent is realized.

Turning Variable Radius

THE SECOND APPLICATION of electronic motor control was made on a standard lathe, tooled to turn an internal clearance radius in a propeller barrel. Engineers designed a special front carriage with a radius turning attachment.

The cycle of this machine is a

standard rapid approach, feed, and rapid return cycle. The position of the front carriage at the start of the approach stroke is shown in Figure 3. At the end of the approach stroke the carriage feeds momentarily until it reaches a positive stop. At positive stop the radius turning attachment feeds the tool for the remainder of the feed stroke.

The change in diameter of the work from the start to the finish is in the ratio of two to one. Obviously, highest production and best tool life will be obtained through constant surface speed.

The load on the spindle motor in this case is derived principally from the cut. The torque required is a function of tool pressure and the distance between the center of the spindle and the point at which the metal is being removed. Tool pressure is constant, but the distance between the center of the spindle and the tip of the tool varies in the ratio of 2 to 1 from the start to the end of the cut. Therefore, the torque decreases, and the speed required increases in the same ratio, which makes this a constant horsepower application.

To drive this machine a 5 hp, 690/2070 rpm constant horsepower motor was selected, with speed variation by field control. The controlling medium is a 4" potentiometer with 300° of rotation to obtain speed change from 690 to 2070 rpm. The motor in this setup must start at low speed, and gradually accelerate to the high speed at the end of the cut, at which time the motor is dynamically braked to stop the spindle.

A potentiometer is mounted on and moves with the front carriage. A cam with a track is fastened to the carriage drive rack which moves only with respect to the carriage when the carriage is in feed against positive stop and the radius turning attachment is feeding. The track in the cam moves a roller which is fastened to a rack. This rack, in turn, rotates the shaft of the potentiometer by means of a pinion. Before rapid return takes place the radius turning attachment first returns to its starting position, reversing the potentiometer arm.

Since the required speed change is approximately through a 2 to 1 range, and since the potentiometer provides a 3 to 1 range in 300° of rotation, it is only necessary to use 207° of the potentiometer travel. In order to rotate the potentiometer shaft 207°, the rack must travel 1.80". While this radius turning attachment is feeding its full stroke the carriage drive rack moves 5-¾" with respect to the carriage. Hence, the cam track must be made so that the 5-¾" of travel by the cam plate produce 1.80" of movement of the rack. The track is not a straight line because the speed change required is a function of the cosine of the angle generated by the tool as it moves toward the end of the cut. Both ends of the cam track are provided with ½" of dwell so that in the event that the speed range is either at the top or bottom of the possible range the potentiometer will not be damaged by over-travel.

In checking the range of surface speed possible by changing the spindle speed change gears, it was decided to set the potentiometer so that the change in spindle speed would be from 1027 rpm at the start of the cut to 1978 rpm at the finish of the cut. With this setting of the potentiometer, the range of surface speeds possible by changing spindle speed gears is from 40 to 420 feet per minute.

Automatic Table Feed Adjustment

THE THIRD APPLICATION of the electronically controlled, adjustable speed motor is to a table feed drive on the special milling machine shown in Figure 4. This machine consists of a movable vertical column mounted on horizontal ways, a swivel type head with vertical power feed and a rotary table with the variable speed drive.

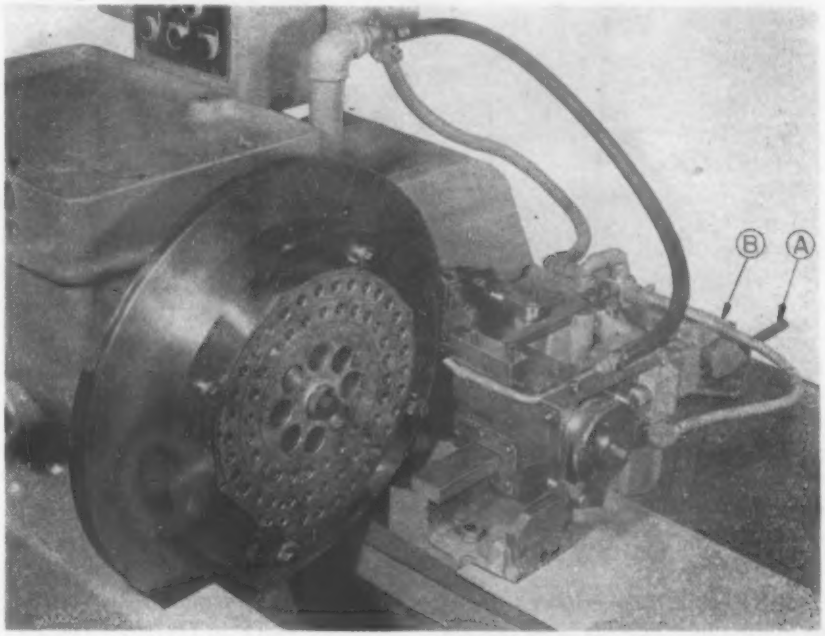

FIGURE 2.
Automatic speed change on electronic drive for automatic lathe is controlled by potentiometer. Rack "A", which is fastened to tool slide, drives gear at "B" to rotate potentiometer 300°. This increases speed of drive from 375 rpm to 1150 rpm as tool moves forward.

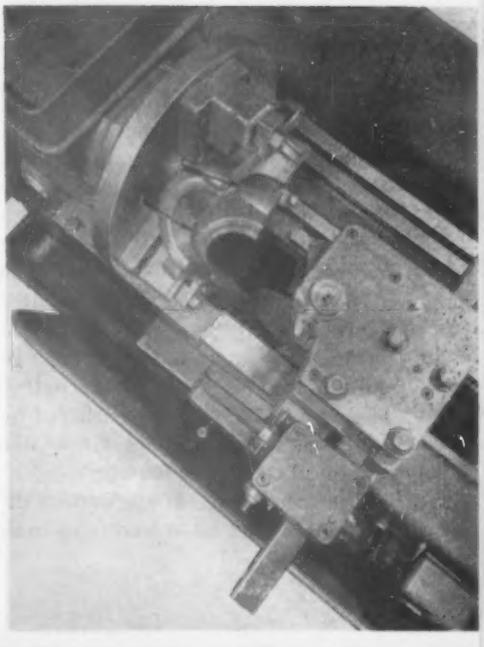

FIGURE 3.
Electronic control was applied to standard lathe to turn an internal clearance radius. Arrows point to two or three surfaces which are machined. Change in diameter of work from start to finish, is in ratio of two to one. Through potentiometer control, keyed to radius turning attachment, constant surface speed is obtained.

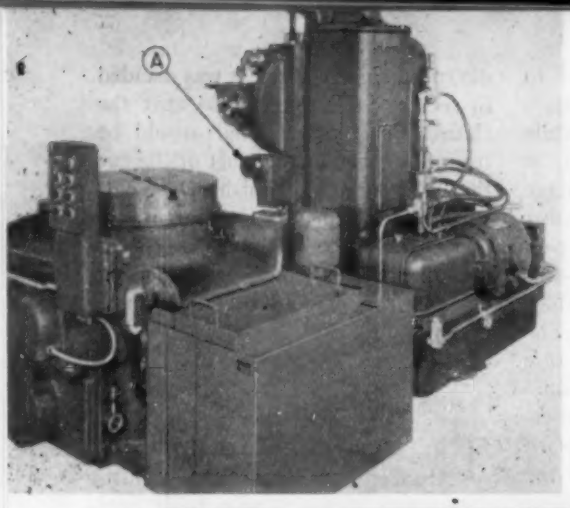

FIGURE 4.

Table on special milling machine is driven by electronically controlled motor. Requirement is for adjustable table feed to compensate for rise and fall cycles of head during a contour milling operation.

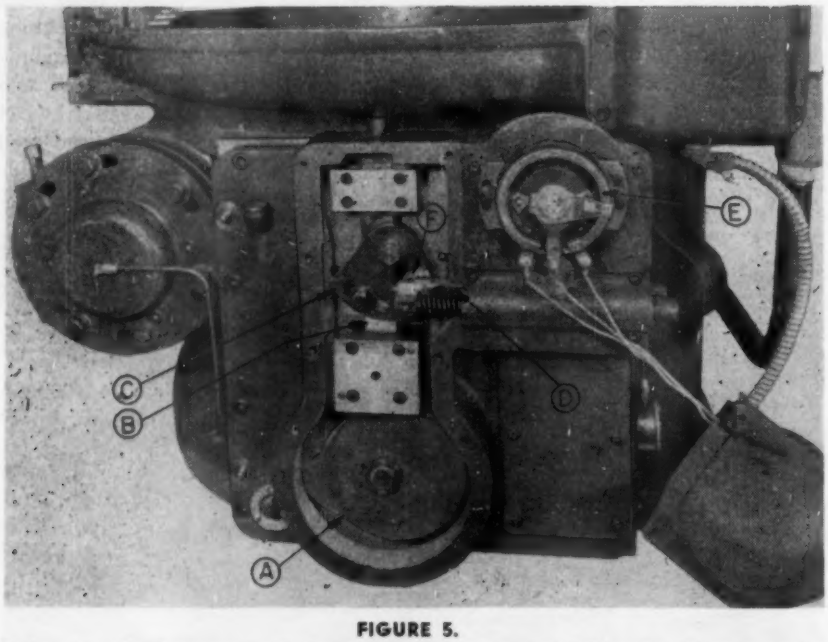

FIGURE 5.

This unit maintains constant feed at cutter during rise and fall cycles of hydraulically operated head. Cam "A" is keyed to contour requirements. It moves cam follower "B" vertically. Feed adjustment plate "C", which is fastened to the cam follower, moves potentiometer "E" by means of roller "C". Potentiometer controls speed of the table drive.

The column can be moved to and from the table, and the head can also be raised and lowered by a hydraulic cylinder.

The table is driven by an electronically controlled, adjustable speed motor with a speed range of 50 to 1150 rpm by armature control in the forward or cutting direction. In the reverse direction the speed of the motor is adjustable from 50 to 1150 rpm by armature and 1150 to 2300 rpm by field control. The motor is rated 2 hp at 1150 rpm and is constant torque with armature control and constant horsepower with field control. The motor is forced-air ventilated by a blower which supplies air at the rate of 50 cu. ft. per minute.

The speed range in the cutting direction provides table feed rates from 0.43″ to 10″ per minute at the work diameter which is 12-½″. The forward feed rate can be adjusted manually, but is adjusted automatically during the cut. In the reverse direction, the maximum rate theoretically is 20″ per minute, but because of decreased torque by field control, the speed of the motor was limited to 1900 rpm or 16.4″ per minute. The reverse speed is manually controlled by a separate potentiometer.

The cycle of this machine is entirely automatic. The table is positioned by a limit switch so that the cycle cannot be started unless a table dog engages the limit switch. With the table in position and the part loaded the operator pushes the "Cycle Start" button. The column then rapidly approaches and finally feeds just before positive stop. At positive stop the head feeds down until roller "A" in Figure 4 engages a cam mounted on the rotary table, and a limit switch on the head starts the rotary table in the cut direction. This cam is so shaped that as the table rotates 360°, the head moves through four identical rise and fall cycles. Upon completing a revolution, a table limit switch reverses the head which rises rapidly to positive stop, and then the column rapidly returns to its starting point. When the column is all the way back, the table reverses.

This machine performs a contour milling operation on aluminum and steel. The machine has a high speed head. The spindle speed is 3400 rpm. The driving motor is belted directly to the spindle. The machines for milling the steel part are identical except that the head is of the geared type with spindle speeds regulated by pick-off gears from 50 to 2915 rpm. Both heads can be swiveled so that the spindles will be 15° from the horizontal either up or down.

CONTROL OF FEED RATE

The tolerances on the machining of this contour are very close. Since the cutter to be used has a ¾″ diameter shank, a varying feed rate at the cutter would result in springing and inaccurate work. Feed rate is maintained by the electronic motor control.

Though the diameter of the work at the cut is 12-½″ which corresponds to a circumference of 42″, the actual cut is approximately 52″ long because of the four rise and fall cycles. Since the deepest angle the cutter climbs is 48° from the horizontal, the actual instantaneous feed rate may be as much as 50 per cent above the table feed rate.

To compensate for the action of the vertical feed the unit pictured in Figure 5 was designed to maintain constant feed at the cutter and also to provide the feed rate adjustment. Since the four rise and fall cycles of the head are identical, the shaft which rotates cam "A" makes four revolutions as the table makes one. Cam "A" moves cam follower bar "B" vertically. Fastened to cam follower bar "B" is the feed adjustment plate "C" which by means of a roller fastened to rack "D" moves potentiometer "E" to adjust the speed of the table drive motor. THE END.

ELECTRONIC CONTROL Applied to Grinding Machines

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TO APPLY an electronically controlled, adjustable-speed motor to the grinding machine, consideration must be given the elements of the machine and the types of controls required. Because the cylindrical grinding machine has the largest number of these controls, it is especially suitable for this study.

If wheel speed can be varied as the wheel is reduced in diameter so that constant surface speed is maintained, greater average production will be obtained from the wheel than is possible at a constant number of revolutions per minute. Ordinarily, changes in wheel revolution which allow the wheel to run up to approximately twice the normal speed are sufficient to take care of the average reduction in diameter.

Work speed, or work revolution, of the part being ground requires a wide range of speed control, since by means of this speed control various diameters within the range of the machine can be handled. Slight differences in the grade of the grinding wheels as well as variation in the material from which the part is made, or variation in heat treatment, can be counteracted by adjusting work speed.

Infeed, which is the movement of the grinding wheel toward the workpiece and finally under slow feed to the final size, requires, various speed combinations in the case of plunge-cut grinding. For example, a semi-automatic grinding machine must provide a quick advance of the wheel to the work, a slower shoulder feed if this is necessary, and then a final slow grinding feed to size and, after the dieout, a quick retraction to the original position. Various combinations of these feeds may also be used to obtain better and more uniform results. The speed ranges on these infeeds vary from as high as 20 feet per minute to feeds as low as .002" and .003". These infeeds must be smooth and uniform to give consistent performance on the part of the grinding wheel and improve both its life, metal-removing capacity, and finish of the work. Picker types of feed have been used, but the screw type in which the wheel is fed to the work in a cut of constant depth produces much better results.

Traverse is required when the part to be ground is longer than the width of face of the wheel available. The unit either must have a reverse clutch or the driving means should permit reversing so that the wheel can be traversed back and forth. Because of variations in work, the traverse speed should be variable and should permit moving the table at speeds as high as 30 and 40 fpm and as low as less than 1" per minute. The high range of speed is for actual metal removal, while the lower range is usually for the truing or dressing of the wheel. Naturally, these speeds vary according to the size of the piece, width of wheel available, and the type of finish that is desired.

TYPES OF DRIVE UNITS

For maximum production these speeds must be constant. Slow speeds used for truing must be uniform to produce a wheel face from which fine finish will result.

Various types of drive units have been used to obtain the above conditions.

Belts and pulleys, gave definite preselected speeds and, when endless belts that were well flexed at the lap were used without belt idlers, smooth operation resulted.

Gear boxes provided definite speed ratios similar to those obtained with the belt drive. Use of gear boxes in connection with the headstock for the work drive and traverse required expensive types of gears such as the herringbone.

These two types of drive were definitely fixed as to speed. If an increment between the selected speeds was necessary, a changeover in the drive was required.

The alternating-current multi-speed motor provides smooth operation but it also has very definite speeds, and these are rather wide apart. This unit also requires rather bulky control.

The adjustable-speed direct-current motor introduced improvements over the previous types of drive. It had a greater number of possible speed variations within its limits and could easily be obtained with a speed range of from three or four to one. It was smoother operating than the gear box, but because of the limited-speed characteristics of the motor, it was necessary many times to have reduction units that incorporated gears or belts and pulleys. Results were thus the same as with the previous drives. These electric motors also required careful balance, since operation at the high end of the speed range increased possibilities of serious vibration markings in the work.

HYDRAULIC MOTORS

Hydraulic motors provided wider speed-range characteristics than the adjustable-speed electric motor and infinitely variable speeds rather than a number determined by the rheostat. Hydraulic motors gave, in many cases, a smooth flow of power, except at very slow speeds when they were inclined to be non-uniform in movement.

Mechanical variable-speed controls have been used incorporating a constant-speed electric motor which drives an auxiliary shaft by means of a V-belt. This belt can be adjusted between angular discs, one pair mounted on the electric motor shaft and the other pair on an auxiliary shaft. This drive has the same infinitely variable feature within a definite range as the hydraulic motor, but in general, it is rather rough for precision grinding.

GRINDER REQUIREMENTS

In studying driving units, it is evident that the grinding-machine designer has been looking constantly for an infinitely variable speed range that is also very smooth in its action. The unit must also be practically free from vibration and provide a very smooth flow of power for constant motion.

Electronic drive offers many advantages to the grinding-machine engineer. The possibility of motor selec-

tion with low speeds affords an opportunity to build driving units which have a minimum of rotating parts. This allows the cost of the mechanism to be reduced. A minimum of rotating parts in the grinding machine also assists in the reduction of vibration.

Advantages of the electronic drive in meeting the requirements of cylindrical grinding are considered in light of need for flexible power application, reduction in rotating parts and elimination of vibration

SIX ADVANTAGES

Some prominent advantages are obtained by the use of electronic control for motors:

1. Utilization of alternating current eliminates need for direct current.
2. Wide speed ranges in either direction of rotation, which may or may not be independently adjustable, can be obtained very easily.
3. Automatic and instantaneous compensation for voltage drop in the direct-current motor, which causes the well-known speed regulation between full load and no load, can be reduced causing the speed fluctuation incident to load changes to approach a minimum.
4. Current-limit features are included which are always effective at starting, also during accelerating and running, thus protecting the controls and the motor.
5. The operating-speed control is entirely from a small device commonly located in the push button station and only one speed-control dial is required to obtain the full range of speed variation.
6. Jogging may be provided at either a preset speed or at some higher or lower speed than operating speed.

Many users of grinding machines today demand that the machines be available so that they can be connected to a single source of power, and in most cases this must be alternating current.

MOTOR-GENERATOR SETS

At this point the natural question arises "Why not use a motor-generator set that will allow the use of a direct-current adjustable speed motor? Then the alternating-current motor is the motor that will be connected to the power source." The use of a motor-generator set invariably creates a bad vibration condition. In the usual drive for a unit, such as a headstock, the grinding-machine engineer desires to mount the motor-generator set on the machine so that this unit can be wired complete before the machine is shipped from the manufacturer's plant.

Electrical engineers will agree that a motor-generator set is a unit whose inherent design precludes the smooth running that is necessary on a grinding machine. It is possible by the use of a motor and a generator to obtain smoother operation, but this combination requires additional rotating parts. Grinding machines, particularly those used on production work, are continually being reduced in size, and the use of more and more complex controls gives less and less area for the mounting of all units.

WIDE SPEED RANGE

Motor-generator sets can be used to advantage on the grinding-wheel drive, but in most cases these sets are of such a size that they must be mounted on the floor beside the machine rather than on the machine.

The electronic drive provides infinitely variable speed over a wide range. Units are available with speed variations of from one to ten and have been made up to one to 100, but in the case of the grinding machine the extremely high speeds are likely to cause trouble from vibration. A speed variation of from one to 10 or one to 16 seems best. Electronic control can be used to advantage on reversing drives since independent potentiometers permit use of varying speeds. Potentiometers in multiple allow various speed changes in one or both directions of rotation.

Automatic and instantaneous compensation for voltage drop in the direct-current motor gives excellent speed regulation between full load and no load, and as the power required varies, it provides reduced speed-fluctuation because of the load changes.

Since the electronically-controlled direct-current motor can be obtained with dynamic braking, it is possible to use a multiplicity of speed-control devices which will quickly shift the motor speed, whether it is in a single direction or in a forward or reverse direction. Since these potentiometers give an infinitely variable speed control, it is possible to get very fine variations in speed control to cover conditions that may be present in the operation of the grinding machine.

Jogging can be obtained in the usual adjustable-speed direct-current motor. The advantage of the electronic drive is that the potentiometer which may be provided for a preset speed is very small and also can be adjusted to obtain the best and fastest jogging speed that can be used in connection with the work being performed.

For table traverse, the low-speed range of the electronically controlled adjustable-speed motor eliminates reduction units and the ease of control permits a rapid reversing operation. The preset constant speed jogging allows accurate operation which can be arranged easily for directional use.

It is possible to eliminate handwheel operation through a rack and pinion by substituting a hand-driven tachometer generator that makes use of the table driving motor for servo-control.

OPTIMUM CAPACITY

In a grinding machine, the most efficient operation is obtained when the wheel is maintained under as constant a cut as possible. This is represented as a condition that would be obtained if the wheel could be operated at its optimum cutting capacity. When this capacity is determined it is possible to arrange the control of the electronic drive so that through the infeed of the grinding wheel the rate of cutting will be maintained, even though it is necessary to vary the feed speed to obtain it.

Electronically controlled motors provide constant torque below base speed which is particularly desirable in a grinding machine, since practically all drives on the grinding machine are constant torque.

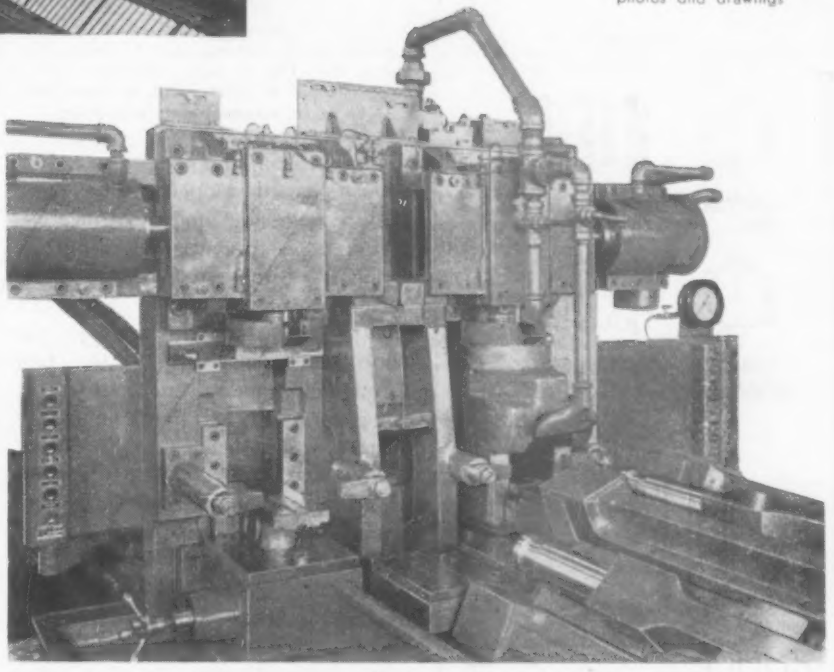
In the application of electronically controlled direct-current motors to grinding machines, an intelligent approach will emphasize redesign rather than application to present design. The varying speed characteristics available in the direct-current motor when controlled electronically allows a big reduction in the number of parts necessary to produce the desired results. This naturally represents a cost saving, and an improved production result.

THE END

BROACHING Fundamentals and Application

ARTHUR BURGAN
AMERICAN BROACH
AND MACHINE COMPANY

American Broach
photos and drawings



This machine broaches the upper half of the slot in a breech ring. The machine has a 72" stroke and 50 tons pulling capacity. Using 6 passes, a maximum of 5/16" stock is removed from three sides. The fixture has two stations, and is mounted upon a horizontal cross-slide to position either station in broaching position, as well as to move the clearance hole into a central position to facilitate the return of the broach.

A breech ring is loaded at one fixture station. The fixture slide is moved to broaching position by push button control. A push button also moves one broach through the work to the automatic puller, and another button starts the cutting stroke. After the broach is pulled through, the fixture moves to a neutral position, and the broach holder is returned through a clearance hole into guide ways in the broach handling cradle. The cradle is indexed to bring the second pass broach into position.

MODERN BROACHING MACHINES, which operate at speeds as high as 45 feet per minute, serve broadly in high-production stock removal. Both horizontal and vertical fixtures are used to push or pull the broach.

Push broaches are used mainly when the amount of stock to be removed is small, requiring a comparatively short broach, and where the strength of the broach in compression is sufficient to resist excessive bending. Many push broaches are used for sizing round holes and splines after heat treatment of jobs produced with a pull broach.

In broaching keyways, both horizontal and vertical machines are used. Large cutter bars are usually handled more conveniently on standard horizontal machines. When cutting a keyway deeper than can be obtained in one pass, liners can be provided to produce correct depth in multiple passes.

In small work, where it is impractical to employ the conventional work horn and cutter bar, a single-spline broach can be used. This type broach is made from solid high-speed steel and the cutter is an integral part of the tool. The body of the broach is guided by the hole. An inverted-spline broach is made like a regular round broach, with a slot ground lengthwise to leave the material for the spline.

For broaching a multiple spline concentric with the hole, the drilled or bored hole may be left undersize. A combination round and spline broach is used (Figure 2). Alternate spline and round cutting teeth finish the spline and the hole in the same pass. Another method uses "pilot" or "dwell" teeth between the spline cutting teeth, which fit the hole in the work similar to a piloted boring bar.

Involute splines, or internal gears, are cut in the same manner as the standard SAE splines. The broach is ground lengthwise with the correct involute form of the teeth, so that each succeeding tooth steps in radially until full tooth depth is reached. In manufacture, it is often necessary to leave this type of broach oversize for sample cuts, particularly where accuracy of as much as .0002" must be obtained.

ROUND-HOLE BROACHING

ROUND-HOLE BROACHING has been adopted because engineers and manufacturers recognize that this is the only means by which a perfectly straight round hole can be obtained on certain classes of work, and that tool expense per piece is only a fraction of that of reamers.

Round-hole broaching has certain definite advantages over reaming and boring. Chief among these are long tool life, speed, and uniformity of size. Tool life depends on the amount of metal removed per cutting edge per minute. It is reasonable to assume, then, that the more cutting edges in a

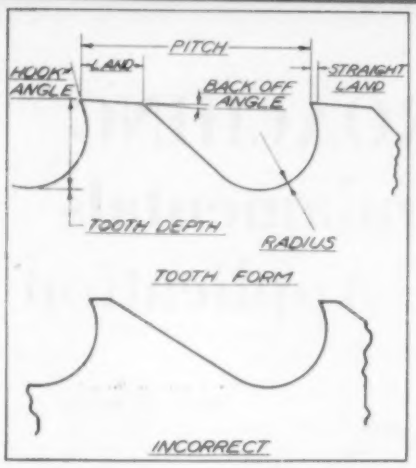


FIGURE 1 (left).

Seven factors are important to tooth form. Hook angle varies with material to be cut, ranging from zero to 15°. Pitch is a function of the length of cut, being determined by the chip thickness and material.

Land determines the tooth strength—note inadequate support in the lower detail. Straight land is generally used only on finishing end to maintain size. Back-off angle, or taper of land, provides work clearance. Usually 2° on roughing teeth, and 1° on finishing teeth, is sufficient.

Radius is provided for tooth strength, and when broaching ductile metal, induces the chip to coil. Tooth depth is proportional to pitch, and is made sufficient to accommodate the chip.

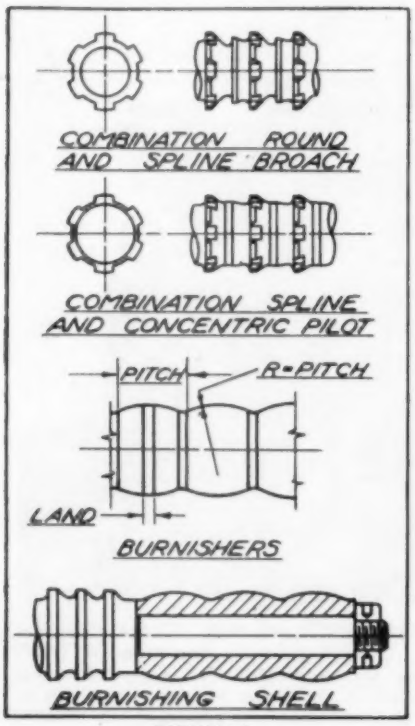


FIGURE 2.

tool, the longer its life. Each tooth passes through the work only once and rarely does the chip exceed .003".

Heavy roughing cuts are taken at the front end of the broach, and the light finishing cuts are taken at the rear with no reduction in speed. Broached holes are smooth, without radial lines. In many cases, it is possible to finish broach a hole in one pass.

If a tooth in a broach is broken, this tooth can be reduced so that it will not cut. However, this presents a double load on the next tooth. It is generally advisable to retaper the broach to distribute the added load over several teeth.

In making up a set of broaches for round holes, each broach must have a pilot to fit the hole produced before its use (Figure 3).

For successful operation, the broach should be kept sharp and re-ground after a land of approximately .0005" has developed. More land requires a greater amount of face undercut to restore original condition, reducing ultimate tool life.

A study of tooth form (Figure 1) shows that a straight land on the teeth maintains life of the tool throughout grinding and sharpening. In general, six straight teeth are deemed advisable.

Finishing teeth of all internal broaches are made all the same size, having gradually increasing lands from about .005" to 3/64" wide. One exception is where the part has a tendency to expand during the cut, which is usually determined for the particular application. In most cases, it is best to start out with the land and remove it afterwards if necessary.

BROACHING IRREGULAR SHAPES

WHERE PRACTICAL, from the standpoint of size and strength, broaches can be made with sizing shells on the finishing end, which can be replaced from time to time.

Irregular-shaped holes are broached by starting in a drilled, reamed, or bored hole, using broaches developing from round to the desired shape. Pull broaches are used almost entirely, since development of the shape usually requires a series of longer broaches.

To broach a cored or pierced hole without drifting, the broach must be held at both ends throughout the cutting stroke. Sometimes, the face of the work which takes the thrust of the broaching cut may not be square with the hole. Then the broach will more or less follow the hole, and after it is underway, the increasing pressure on the angular thrust face may bend and possibly break the broach. In these instances, it is desirable to use an equalizing fixture, which will automatically align itself as the broach enters the hole.

For broaching exceptionally long holes, the work may be submerged in a bath, so that a generous supply of coolant is available.

CHIP BREAKERS

TO GET RID of chips, broaches are provided with "nicks" or chip breakers. Without these on a round broach, for example, it would be difficult to remove a full round chip of considerable strength, from between each tooth. Chip breakers are usually made 1/32" wide in broaches up to ¾" in diameter, and are spaced ⅛" apart. In broaches over ¾" in diameter, they are made 3/64" wide and spaced ¼" apart.

The correct design of chip breakers, insofar as size is concerned, is obtained by being sure that the chips do not come together at the bottom of the tooth. It must be deep enough to be below the surface of the tooth ahead.

There must never be less than two teeth in contact. Only one tooth in contact results in a nibbling cut.

Similar to sizing shells are burnishing shells which are used for sizing and improving finish. Burnishers permit holding the tool rigidly in a press, and pushing it through the work (Figure 2).

Since the burnishers are made slightly larger than the finishing teeth it is possible to strip back without injury to these finishing teeth. Burnishing shells can be made from tool steel, chrome plated and replated indefinitely. Design of burnishers depends on the work material. Burnishers for cast iron, babbitt, and bronze are made with a land of 1/32". For steel, semi-steel, and brass, they are made without land. This is done to prevent pick-up on the surfaces of the tool, which would spoil the finish of the hole.

The amount of stock left for burnishing should be divided over several burnishing buttons. In cast iron, it is usual to burnish .001". With four buttons, distribution might be .0004" on the first button; .0003" on the second button; .0002" on the third button; and .0001" on the fourth. In steel, leaving .0005", steps might be .0002" on the first and second buttons, and .0001" on the last.

SURFACE BROACHING

SURFACE BROACHING requires a more elaborate setup than most other applications. The fixture must hold the work securely, and a broach holder is required to hold the tools. A prime requisite is enough production to justify the investment. Also, the work must be able to withstand broaching pressures which are usually higher than on other machining operations. Where practicable, surface broaching is a fast efficient method of machining, producing an accurate, smooth finish, over long runs.

The fundamental design of a surface broach is similar to that of internal broaches. However, the tools can be mounted in a holder, providing a convenient means of adjustment to maintain size. This is accomplished by placing liners, or tapped gibs, behind the broach. These features also provide a convenient method of setting up the operation for increasing or reducing the depth of cut.

Use of shims also permits extensive regrinding of teeth. Surface broaches can also be made in short sections and mounted in a broach holder as one assembly. Worn finishing sections can be moved down, and a new finisher added.

In setting up surface-broaching operations, it is advantageous to make the fixture adjustable in and out on the machine table. This can be accomplished by placing a jack screw (Figure 4) behind the fixture, and elongating the hold-down holes in the fixture base.

Rugged fixtures are of utmost importance in surface broaching. Clamps should be made heavy enough so that they will not bend or spring. Fixture support blocks should have a tough core or the result may be detrimental to the finish obtained.

Support blocks should be made to support the work as close to the cut as possible. A good rule to follow, is to set these blocks to within .010″ to .015″ of the finish teeth on cast iron, and .030″ to .040″ for steel. Bringing the blocks closer on cast iron prevents break-out at the bottom of the cut. Intricate shapes and forms can be surface-broached. This is naturally more expensive, but by proper analysis of the problem, expense can be held to a minimum.

Surface broaching on horizontal machines is more expensive, since the broach holders must be made of hardened and ground materials, and must be guided in the fixture, in hardened and ground guides.

Vertical pull-up machines are capable of pulling 6 or 8 broaches at one time. Work is loaded over the broach pulling shank or shanks. Elevators which raise the broaches into the automatic pullers, energize a limit switch which starts the main ram on the cutting stroke. The work is carried on the broaches to the work table, and thrust is taken against a hardened and ground thrust plate.

At the end of the broaching stroke the piece or pieces may be dropped onto an angle table and into a container. The main ram then returns the broaches to the starting positions. A soft guide bushing in the fixture protects the broach teeth during this return stroke. Since the teeth of the broach face upward, the coolant is carried through the work, and each tooth forms its own reservoir.

BROACH MAINTENANCE

PROPER BROACH CARE should begin when the tool is received by the user. Any misuse, such as allowing the broach teeth to strike a hard object, causing minute fractures of the cutting edge, will be reflected in the cutting quality.

Upon arrival of the broach, the face angle and other dimensions should be carefully checked and recorded for resharpening purposes. Try the part over the pilot of internal broaches. If the pilot has to be driven into the part, a broken broach usually results.

Place the broach in a puller and check the pullhead, work bushing, and key for proper fit. Enter a part on the broach pilot, then load the complete assembly in the broaching machine, bringing the work against the work bushing with the broach engaged with the pullhead. If the backrest of the machine is available, this should also be engaged. In this position, the broach should be checked for alignment. A crooked hole or broken broach will result from misalignment.

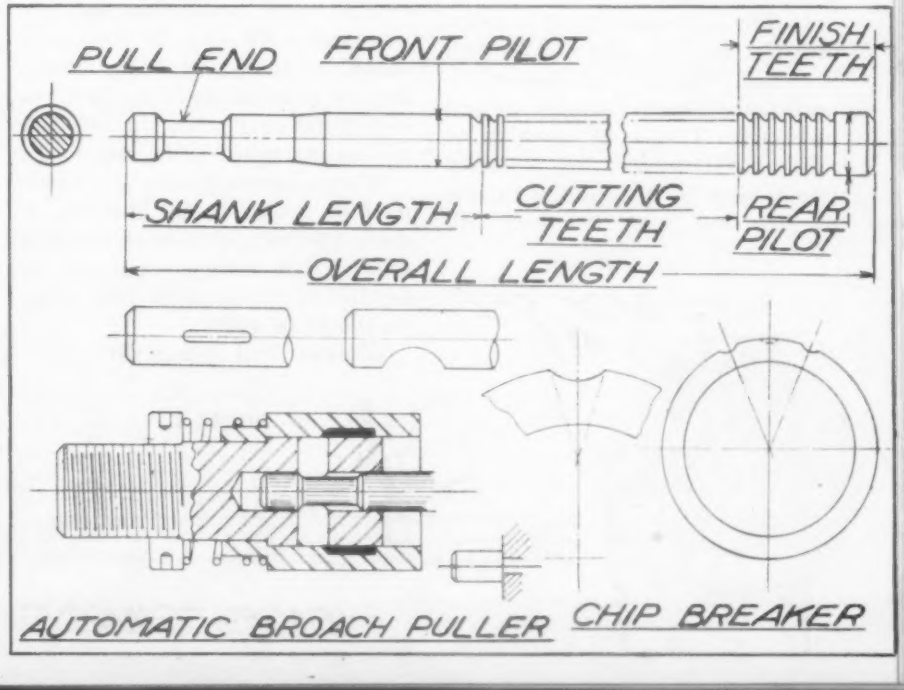
The first piece should be broached at slow speed to determine whether the setup is correct. The operator should watch the broach coming through the part to determine whether the chips have sufficient room for curling or whether they improperly pack up in the bottom of the teeth. Steel chips should have a tendency to pop up as the tooth comes through the part.

The pressure gauge reading, giving the number of pounds required to pull the broach, should also be recorded, since the pulling pounds will be greatly increased when the broach begins to dull.

Never stop and start a broach in the center of a cycle, as the starting load is thus greatly increased. A small broach may easily be broken in this manner.

Keep the broach clear of chips, since packing will break the tool. A brush may be used for this purpose (never a wire brush).

"Close-in" or dulling is indicated



(Right): **FIGURE 3.**

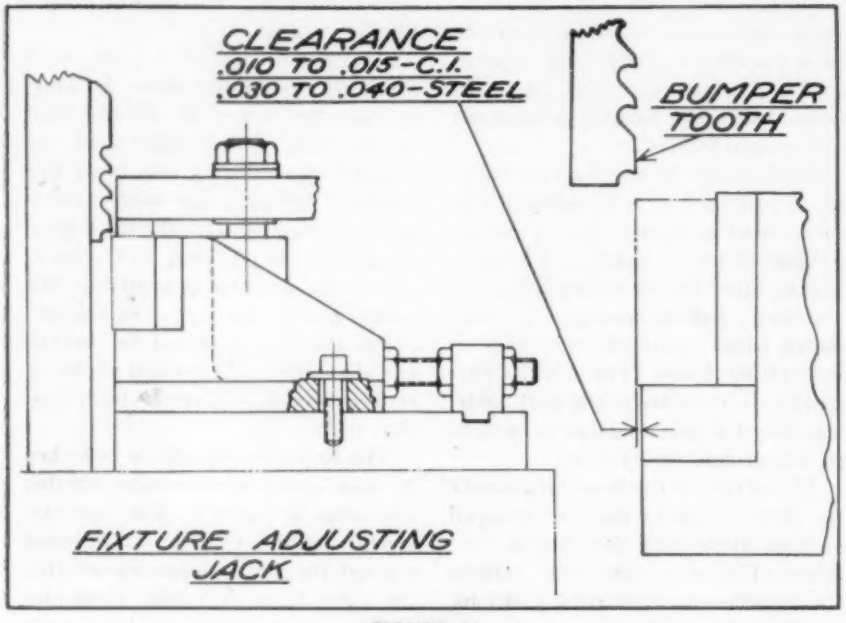


FIGURE 4.

when parts become slightly smaller in size (or larger for external broaches). The finish of the broached surface will also show streaks and tears.

BROACH SHARPENING

SHARPENING, USUALLY DONE on a universal grinder, should be performed carefully and skillfully (Figure 5). Tool characteristics which should be retained are face angle, depth, radius, straight land, and step from tooth to tooth.

Broaches of small cross-section (internal or external) must be sharpened oftener than the larger tools to prevent breakage from increased pressure. This occurs when considerable straight land develops, causing frictional strain.

Usually when sharpening is necessary, the front face only of each tooth is ground. Only enough grinding to remove the slightly rounded edge is necessary. The same amount of stock should be removed from the face of each tooth, thereby retaining the step from tooth to tooth. All sharpening operations should be done on a rigid machine.

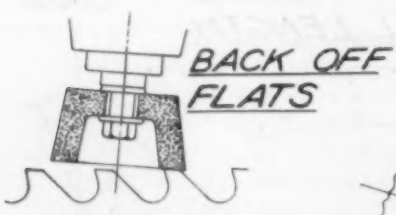
Should a tooth become weakened, or break, several teeth should be retapered to take the added burden.

When internal broaches are used in abrasive metals, considerable land is sometimes formed on the tops of the teeth. Grinding the face may not reduce the land sufficiently. The broaches are then backed-off again. This operation is a delicate one since the broach must run true between centers. It is recommended that the roughing teeth only receive this treatment as any attempt at grinding the finish teeth in this manner may reduce size.

Remember that most internal broaches are provided with a series of straight teeth to maintain size. The first two teeth only of this series should be sharpened. The remainder are reserved until the first two have worn small, then the following two are sharpened, and so on.

When a broach is new, the straight teeth do not have chip breakers. As the tool wears, and the teeth that once were straight become small and are required to remove metal, chip breakers should be added.

When external broaches are required to cut abrasive metals, forming of considerable straight land will also cause frictional strain. Surface broaches may readily be resharpened by grinding the hook angle or tooth face, and occasionally they should be ground on the land when they show wear. After being resharpened on the land, the teeth should be backed off or relieved up near the tooth cutting edge.



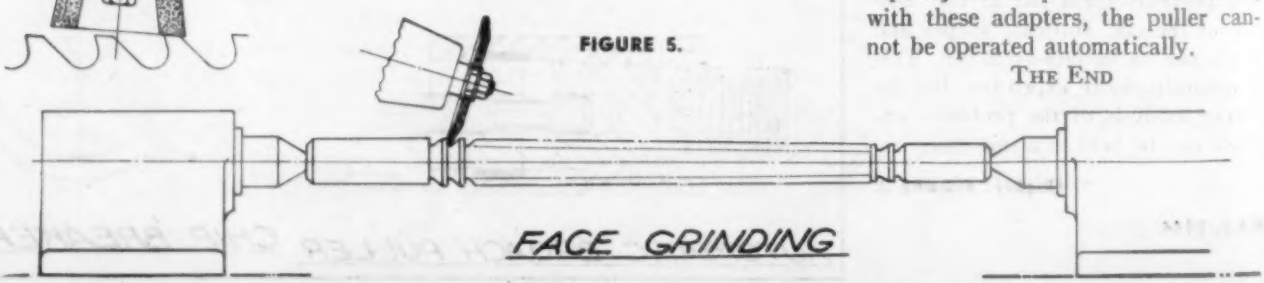


FIGURE 5.

AUTOMATIC BROACH PULLER

THE AUTOMATIC 4-jaw puller, used for pulling broaches with round pulling shanks, has been used successfully for a long time, relieving the operator of the necessity of assembling a key or pin into the pullhead before starting the machine.

The same type of automatic operation has been developed for keyway broaches. Heretofore, these broaches or cutter bars have been supplied with a threaded end, which is fastened into the threaded puller for the duration of the production run of parts.

The work had to be threaded over the broach in the majority of applications. The new keyway-broach puller can now be made for automatic operation, since at the end of the return stroke of the machine slide, the stop screw drives the wedge block back, allowing the pulling jaw to move upward under spring pressure until it is clear of the broach. The broach can then be removed.

After reloading the fixture, or work horn, the broach is then placed in position and automatically connects as the operator starts the machine cutting cycle.

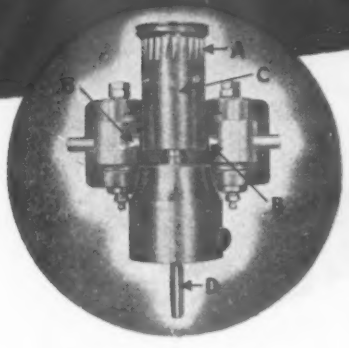
Further, the notch in the broach shank leaves the broach much stronger than did the screw thread. This is particularly important where threads as small as ¼-20 are sometimes used.

To facilitate the use of threaded broaches in existence, adapters are supplied to convert them for use in the new-type puller.

For different depths of broaches, several wedge blocks are also supplied to cover the range of sizes within the capacity of the pullhead. Of course, with these adapters, the puller cannot be operated automatically.

THE END

Get Extreme Thread Accuracy Reduce Rejects –Save Material Eliminate Tap Breakage



THE SECRET LIES IN THE NEW LEAD SCREW PRINCIPLE

THREADING or tapping is often the last operation on an accurately machined part. Inaccuracy of thread can mean rejects with the scrapping of critical materials and the loss of all the costly precision operations which have gone before.

The Warner & Swasey Precision Tapping and Threading Machine introduces a new principle to insure extreme accuracy in cutting internal and external threads—a patented combination of lead screw and electrically actuated guide fingers. The upper portion of the lead screw (A) is a hob which cuts mating threads into the brass guide fingers (B) to match the pitch of the lead screw (C) and the tap (D). Solenoid action engages the guide fingers and lead screw to maintain precision lead during the tap travel. This patented mechanism compensates for wear of guide fingers against lead screws and eliminates lead errors and backlash.

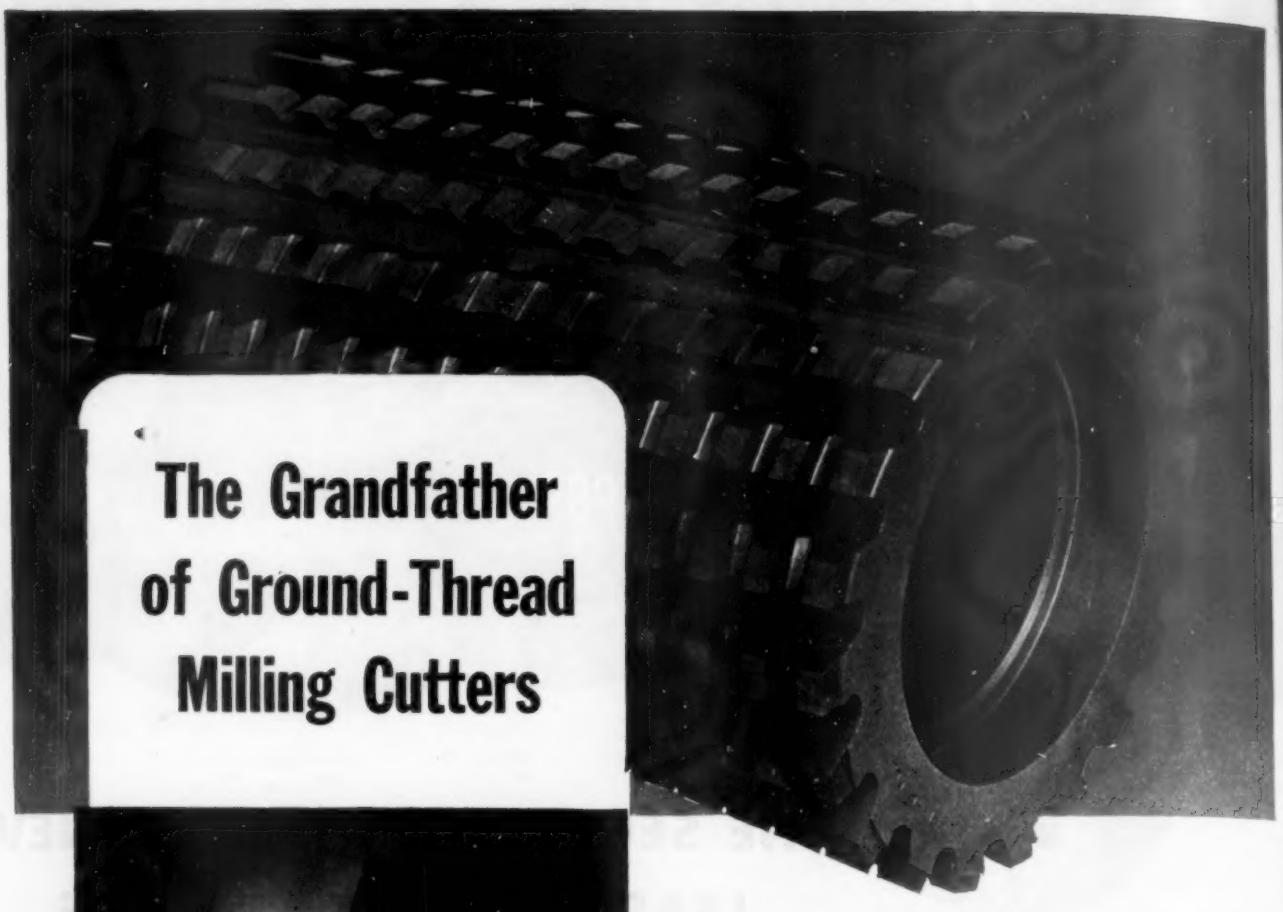
On these Warner & Swasey machines, operators —men and women with average training—can cut class 3, 4 and even 5 gage fits in hard and soft materials. Numerous case histories tell of production going up while scrap loss and tap breakage go down.

A catalog describing four models of the Warner & Swasey Precision Tapping and Threading Machines for large and small work capacities from 0-80 to 1½", free on request. Ask your Warner & Swasey representative or write

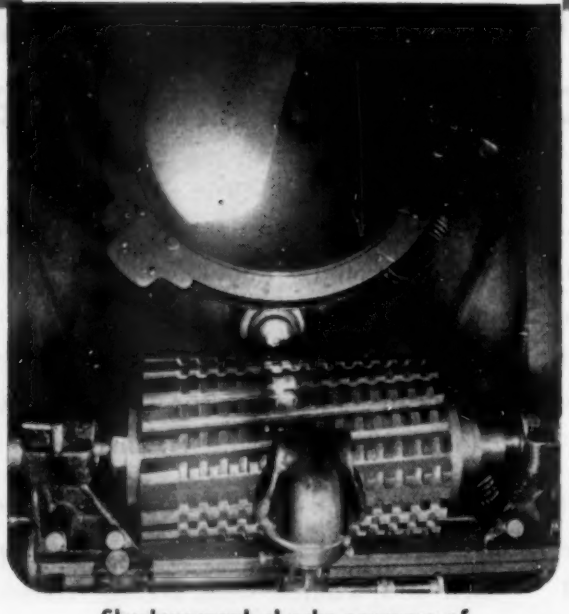
YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

WARNER & SWASEY Cleveland

TURRET LATHES, SADDLE AND RAM TYPES • CHUCKING AND BAR TOOLS • PRECISION TAPPING AND THREADING MACHINES



The Grandfather of Ground-Thread Milling Cutters



Shadowgraph checks accuracy of PM Multiple Thread Mill to 1/10 of one thousandth of an inch.

We make them all sizes—from giants like this, 8″ dia. x 12¾″ long—to little ones down to half inch diameter.

And whatever their size or pitch or number of cutting edges, they all belong to the same family—the PM family.

With a lot of experience on multiple thread mills, we've got a pretty good idea of what these important tools are expected to do.

So we make them all to the same standards of precision and accuracy and hardness we require in our own tools. And then check every one—on the most modern type of inspection equipment—just to make extra sure of what we already are sure of.

If you use multiple thread mills let us have your specifications—to quote you prices and delivery dates. You can put a lot of confidence in any cutting tool that carries the PM Diamond emblem.

PM CO

ARMY NAVY

The PIPE MACHINERY COMPANY Cleveland, O.

PRODUCTION DATA SHEET

CONVERSION CHART

HYDRAULIC FEED IN INCHES PER MINUTE
INTO
INCHES PER REVOLUTION

•

EDWIN FRANKLAND

Spindle RPM	FEEDS IN INCHES PER MINUTE									
	1	2	3	4	5	6	7	8	9	10
100	.010	.020	.030	.040	.050	.060	.070	.080	.090	.100
150	.0066	.0134	.020	.0266	.0333	.040	.0466	.0533	.060	.0667
200	.005	.010	.015	.020	.025	.030	.035	.040	.045	.050
250	.004	.008	.012	.016	.020	.024	.028	.032	.036	.040
300	.0034	.0066	.010	.013	.0167	.020	.0234	.027	.030	.0334
350	.0029	.0057	.0085	.0114	.0143	.0171	.020	.0229	.0257	.0286
400	.0025	.005	.0075	.010	.0125	.015	.0175	.020	.0225	.025
450	.0022	.0044	.0066	.009	.0111	.0133	.0155	.0177	.020	.0222
500	.002	.004	.006	.008	.010	.012	.014	.016	.018	.020
550	.0018	.0036	.0054	.0072	.0090	.0109	.0127	.0145	.0163	.0181
600	.0017	.0034	.005	.0068	.0083	.010	.0116	.0136	.015	.0167
650	.0015	.0032	.0046	.0063	.0077	.0092	.0108	.0126	.014	.0155
700	.0014	.0029	.0042	.0058	.0071	.0085	.010	.0116	.013	.0143
750	.0013	.0027	.0040	.0054	.0067	.008	.0093	.0108	.012	.0134
800	.0012	.0025	.0037	.005	.0062	.0075	.0087	.010	.0112	.0125
850	.0012	.0023	.0035	.0047	.0059	.007	.0082	.0094	.0106	.0118
900	.0011	.0022	.0033	.0044	.0055	.0066	.0077	.0088	.010	.011
950	.001	.0021	.0031	.0042	.0052	.0063	.0073	.0084	.0095	.0105
1000	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
1050	.0009	.0019	.0028	.0038	.0047	.0057	.0066	.0076	.0085	.0095
1100	.0009	.0018	.0027	.0036	.0045	.0054	.0063	.007	.0083	.0091
1150	.0008	.0017	.0026	.0034	.0043	.0052	.006	.007	.008	.0087
1200	.0008	.0016	.0025	.0033	.0041	.005	.0058	.0066	.0075	.0083
1250	.0008	.0015	.0024	.0032	.004	.0048	.0056	.0063	.0072	.008
1300	.0007	.0015	.0023	.003	.0038	.0046	.0054	.006	.0069	.0076
1350	.0007	.0015	.0022	.0029	.0037	.0044	.0052	.0058	.0067	.0073
1400	.0007	.0014	.0021	.0028	.0035	.0042	.005	.0056	.0064	.007
1450	.0007	.0014	.002	.0027	.0034	.004	.0048	.0054	.0062	.0068
1500	.0007	.0013	.0019	.0026	.0033	.0038	.0046	.0052	.006	.0066

NOTE: This is the thirty-first of a series of Data Sheets to be published in THE TOOL ENGINEER. A handy three ring binder can be secured at any dime store to hold the sheets for quick reference.

CONVERSION CHART • HYDRAULIC FEED

IN INCHES PER MINUTE INTO INCHES PER REVOLUTION

Spindle RPM	FEEDS IN INCHES PER MINUTE 1	2	3	4	5	6	7	8	9	10
100	.110	.120	.130	.140	.150	.160	.170	.180	.190	.200
150	.0733	.080	.0866	.0933	.100	.1066	.1133	.120	.1266	.1333
200	.055	.060	.065	.070	.075	.080	.085	.090	.095	.100
250	.044	.048	.052	.056	.060	.064	.068	.072	.076	.080
300	.0367	.040	.0433	.0467	.050	.0533	.0567	.060	.0633	.0667
350	.0314	.0343	.0371	.040	.0428	.0457	.0486	.0514	.0543	.0571
400	.0275	.030	.0325	.035	.0375	.040	.0425	.045	.0475	.050
450	.0244	.0266	.029	.0311	.0333	.0355	.0377	.040	.0422	.0444
500	.022	.024	.026	.028	.030	.032	.034	.036	.038	.040
550	.020	.0218	.0236	.0254	.0272	.0291	.031	.0327	.0345	.0363
600	.0183	.020	.0217	.0233	.025	.0266	.0283	.030	.0316	.0333
650	.017	.0184	.020	.0215	.0233	.0246	.0261	.0277	.0292	.0307
700	.016	.0171	.0186	.020	.0214	.0228	.0243	.0257	.0271	.0286
750	.015	.016	.0173	.0186	.020	.0213	.0226	.024	.0253	.0266
800	.0137	.015	.0162	.0175	.0187	.020	.0212	.0225	.0237	.025
850	.013	.014	.0153	.0165	.0176	.0188	.020	.0212	.0223	.0235
900	.0122	.0133	.0144	.0155	.0166	.0177	.0188	.020	.0211	.0222
950	.0116	.0126	.0137	.0147	.0158	.0168	.018	.019	.020	.021
1000	.011	.012	.013	.014	.015	.016	.017	.018	.019	.020
1050	.0105	.0114	.0124	.0133	.0143	.0152	.0162	.0171	.0181	.019
1100	.010	.0109	.0118	.0127	.0136	.0145	.0154	.0163	.0172	.0181
1150	.0096	.0104	.0113	.0122	.013	.0139	.0147	.0156	.0165	.0174
1200	.0092	.010	.0108	.0117	.0125	.0133	.0141	.015	.0158	.0167
1250	.0088	.0096	.0104	.0112	.012	.0128	.0135	.0144	.0153	.0159
1300	.0084	.0092	.010	.0108	.0115	.0123	.0130	.0138	.0146	.0151
1350	.008	.0089	.0096	.0104	.0111	.0118	.0126	.0133	.0141	.0147
1400	.0077	.0086	.0093	.010	.0107	.0114	.0121	.0128	.0136	.0143
1450	.0074	.0083	.0086	.0096	.0104	.0106	.0117	.0124	.0131	.0138
1500	.0071	.008	.0086	.0093	.010	.0106	.0113	.012	.0126	.0133

Eliminate Trial and Error When Working with Hydraulic Feed

THE FOREGOING CHART affords a quick method of converting hydraulic feed in inches per minute into inches per revolution. It was developed according to formula to eliminate expensive trial and error methods of setting up and operating machine tools which are equipped with hydraulic feed mechanisms.

The basic formula used in making the necessary calculations is:

$$\text{Feed per spindle rev.} = \frac{\text{feed in inches per minute}}{\text{spindle rpm}}$$

An example of the calculation is given in the following case which assumes a required feed per revolution at spindle speed of 1000 rpm, and a feed rate of 10" per minute.

$$\frac{10}{1000} = .010 \text{ feed per revolution}$$

This conversion chart can be used by the operator to select the exact feed per spindle revolution which will ensure the maximum safe production when using carbide-tipped tools.

THE CRIB

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Roller Type Reducing Die for Square or Rectangular Thru Draw

THE DIE shown in the drawing below embodies a unique application. In addition, the sizing of the drawn product is made by placing a sizing die below the reducing unit.

This particular die was made for a drawn shell of .030" deep drawing brass. The shell is first drawn on a conventional first operation die to the shape shown in Figure 1. Figure 2 shows the shell after it has been reduced and sized by rollers "A" and the sizing die "B".

Rollers "A" are of tool steel, hardened and ground all over. These rollers run in bearing blocks "C", which are constructed of tool steel, hardened and ground. The rollers are also backed up by filler blocks "D". Plates "E" function as retainers for the rollers.

In operation, the rollers are greased previous to setting the die into a press, and the surplus draw compound used on the shells lubricates the sizing die.

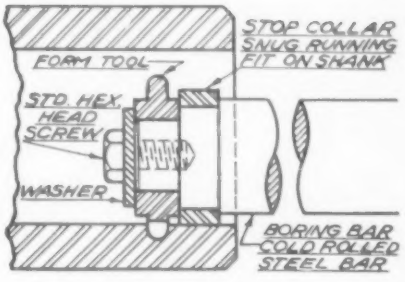
Maintenance is simple. If the die becomes loaded from brass flakes, and drags in operation, the rolls can be removed by removing the roll-retainers. The die can then be cleaned thoroughly, regreased and reassembled while in the press.

●

Tool for Boring to Specified Depths

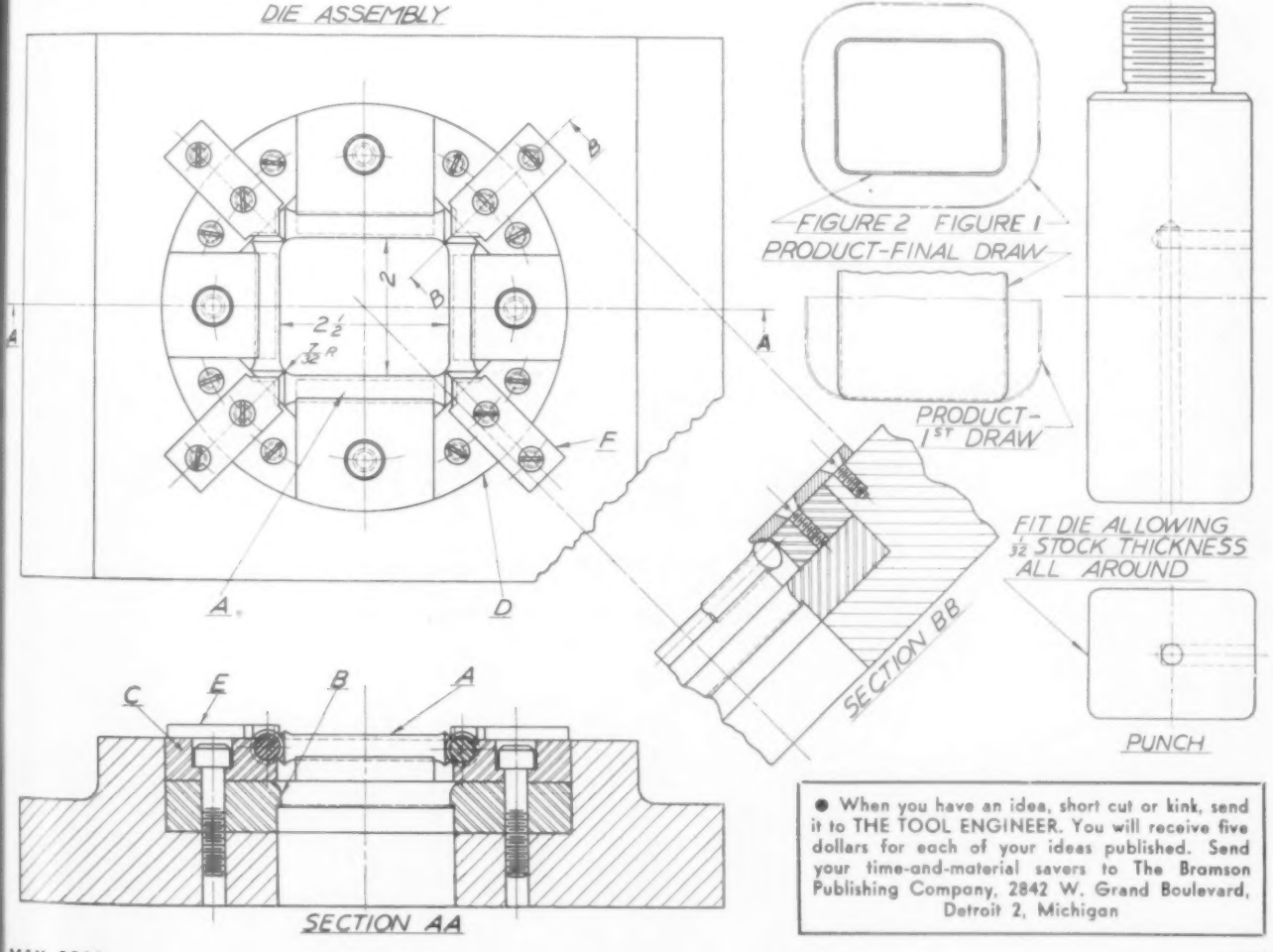
FREQUENTLY, a part drawing calls for a recessing in a deep hole that has been bored out in the lathe.

In order to take care of the hazard of cutting the recess too deeply, when a specified depth is indicated on the drawing, the adaptor shown in the



drawing above was applied to the problem.

The bar is run into the bore to the desired distance. The feed is then operated by hand, the cutter plunging into the work until the collar stops against the inside face of the bore. Highlight feature of the adaptor is that the tool need not be withdrawn to determine or check the depth of recess when a production run is anticipated.



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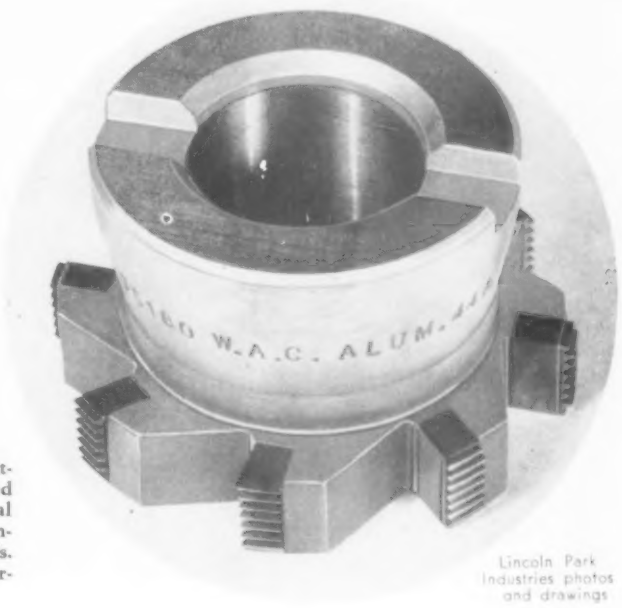
CARBIDES: Something New in Taps

Foreshadowing wider utilization of carbides in taps is the successful application of the material in a tool now produced for an aircraft engine job



Lincoln Park Industries photos and drawings

FIGURE 1. Carbide-tipped 90° buttress thread tap used by Wright Aeronautical on radial aircraft engine cylinder heads. The tap body is air-hardened tool steel.

WALLACE SCOTTEN
ASSOCIATE EDITOR

THROUGH THE DEVELOPMENT of a new method for grinding radial relief on the straight side of the thread, carbides now are being utilized in the manufacture of 90° buttress thread taps. By applying this new method, along with grinding setups which it had developed previously for the production of carbide thread gages, Lincoln Park Industries, Incorporated, are turning out this tap for use in aircraft engines.

Wright Aeronautical Corporation is using the carbide tap in its Greenlee automatic production line on the exhaust valve insert hole in radial engine cylinder heads.

In revealing this development, Lincoln Park engineers point out, they do not wish to convey the impression that carbide taps for a wide range of purposes now are in production. Substantially more development will be necessary to widen the range of application, they say. This particular job proved feasible, as will numerous others eventually. Yet, for the present, each application must be considered individually and special methods developed for its production.

With the exception of a new method of grinding radial relief on the straight side of the thread, other grinding setups used on this job represent the application methods previously used in the production of carbide thread gages. Grinding the relief on the straight side of the thread became a relatively simple job by inserting a 10° wedge between the wheel-spindle housing and its bracket on a Number 33 Ex-Cell-O thread grinder with back-off attachment.

The dressing of the .003″-.0045″ radius into the wheel required the use of a wheel-crushing method previously developed for grinding Whitworth formed threads. The Ex-Cell-O machines employing the dressing device have been thus equipped by this tool and gage builder and now are used for grinding carbide Whitworth formed threads in England and Canada.

DIAMOND WHEEL REQUIREMENTS

The entire thread grinding procedure is dependent upon obtaining, and maintaining, sufficiently accurate shape and truth on the diamond wheels. Despite the fact that this work now is in production, it should not be assumed that this is easy to do, or that it is obtained automatically, as the thread forms are on wheels for grinding threads on steel. The job requires diligent effort and attention on the part of highly skilled and experienced operators.

Carboloy, grade 44A, standard blank No. 1370, is used on this job. Other grades will be tried as production experience is gained, it is said.

Norton diamond wheels, 320-grit and standard concentration, are used in grinding all of the thread elements, including the 3° hook on the cutting face and chamfer. The hook is given a lapped finish after grinding to assist in chip removal. This finishing is done with a cast-iron wheel charged with fine diamond powder.

The tap body (Figure 1) is made from air-hardened tool steel. The carbide cutting tips are ¼″ x 7/16″ x ⅝″, and are furnace-brazed to the body with copper, in a hydrogen furnace. The brazed tool is cooled slowly in the furnace atmosphere, resulting in a body hardness of Rockwell C-40-45.

The driving slot in the back face of the tap is held to a tolerance of plus or minus .0003″ for width, and is off center. Its location must be maintained in relation to the teeth of the tap in order that correct register will be maintained with the rough tapping done in a previous operation.

Taps are mounted on special arbors with off-center driving tongue (Figure 2). This tongue relocates the tap for each grinding operation. Visible at the left in this photograph is the special back-off cam required to grind at the fast rate of relief.

The tap has full radial relief starting at the cutting edge, to .004″ low at the back edge of the carbide insert. The 90° face has approximately .0005″ radial relief. Relief on the 90° face is obtained by presenting the axis of the grinding wheel at a 10° angle to the axis of the tap, and using the standard actuating back-

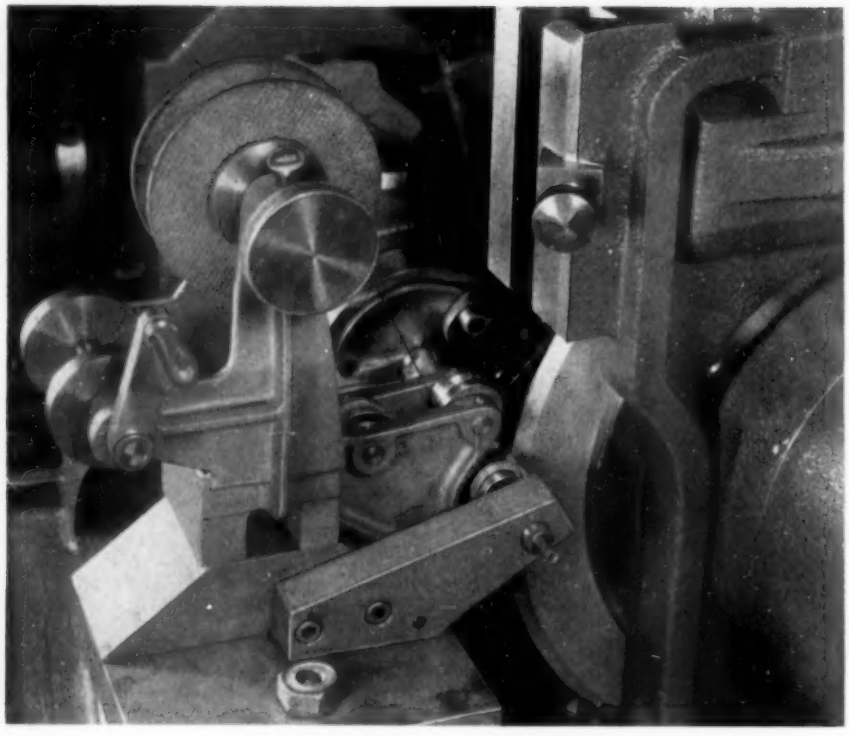


FIGURE 2.

Carbide-tipped tap mounted in Ex-Cell-O machine on special arbors with off-center driving tongue which relocates workpiece for each operation.

off mechanism provided in the Ex-Cell-O machine, which infeeds the grinding wheel itself, perpendicular to its own axis.

The dressing mechanism used to dress the angular faces on the diamond wheel is of special design and replaces the standard or universal dresser ordinarily supplied on the machine. It consists primarily of a motor-driven ball bearing Ex-Cell-O spindle, mounted on preloaded ball ways which permit hand-actuated reciprocation. The entire mechanism is mounted on a swivel base which permits 130° of angle adjustment. The dresser is clamped in its correct angular position and reciprocated across the wheel face by hand.

Constant infeeding is necessary in this operation to compensate for wear on the dressing wheel. The dressing wheel is Norton Silicon carbide, Grade 3780M, and revolves at conventional grinding speed.

Figure 3 shows the dressing mechanism used in crushing the .004″ radius into the diamond wheel which produces the radius required at the crest of the tap thread.

FIGURE 3.

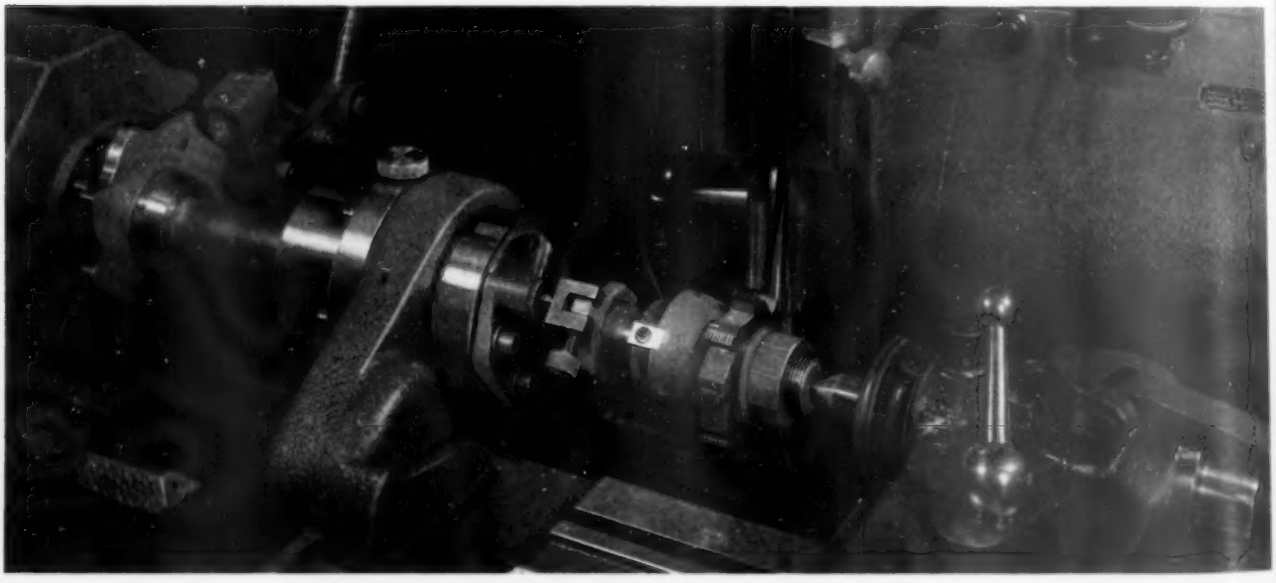
Dressing mechanism used in crushing the .004″ radius into the diamond wheel which produces the radius required at the crest of the tap thread.

This method of dressing is capable of great accuracy, and is limited only by the accuracy of the wire used. Great accuracy is not required however, on this job as the radius is used only to eliminate a sharp-cornered stress point in the part.

Essentially, the dresser consists of two spools, a guide arbor, and angular supporting flanges for the grinding wheel. The upper spool carries the unused wire and is provided with a friction brake which resists the uncoiling of the wire and keeps it taut. The uncoiled part of the wire is passed under the upper guide, completely around the diamond wheel, over the guide arbor, and then rewound on the lower spool.

DRESSER MECHANISM

The mechanism is fed into the grinding wheel by the cross-feed screw of the machine. Pressure is provided against the wheel at the point where the wire passes over the arbor, generating a crushing force against the diamond wheel. The drive belts are removed from the spindle during this operation, and the wheel is revolved by the traction of the wire wound around it. Power is provided by hand to the crank on the rewind spool.



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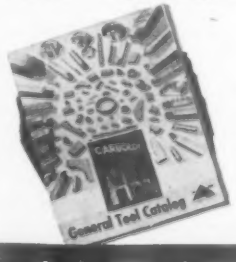

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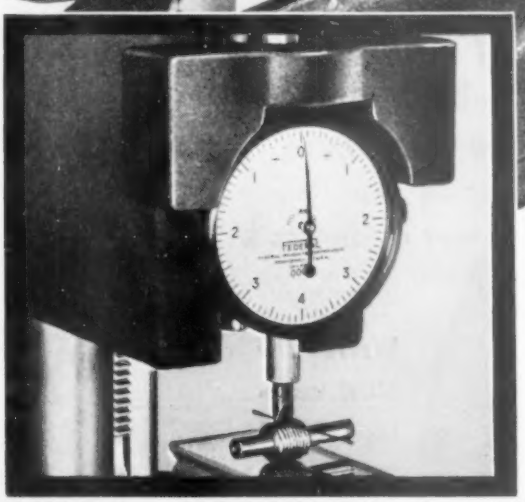

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PRECISION MEASURING INSTRUMENTS

FIGURE 4.

Thread form on carbide 90° buttress tap produced for use on Wright Aeronautical's Greenlee automatic production line working on aircraft cylinder heads.

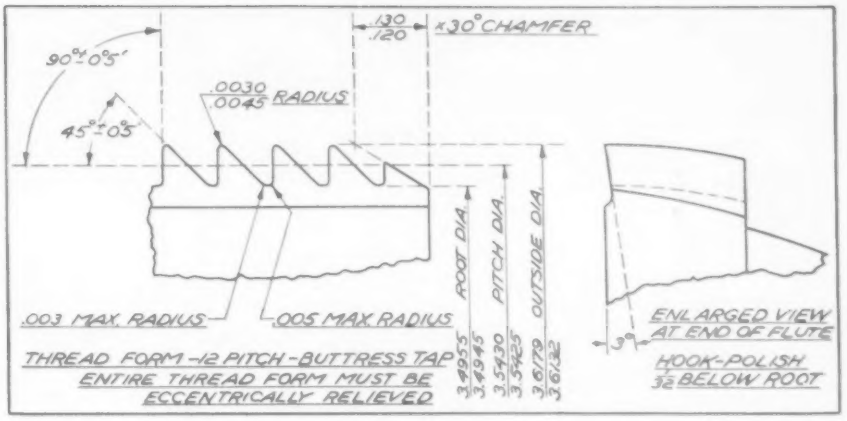
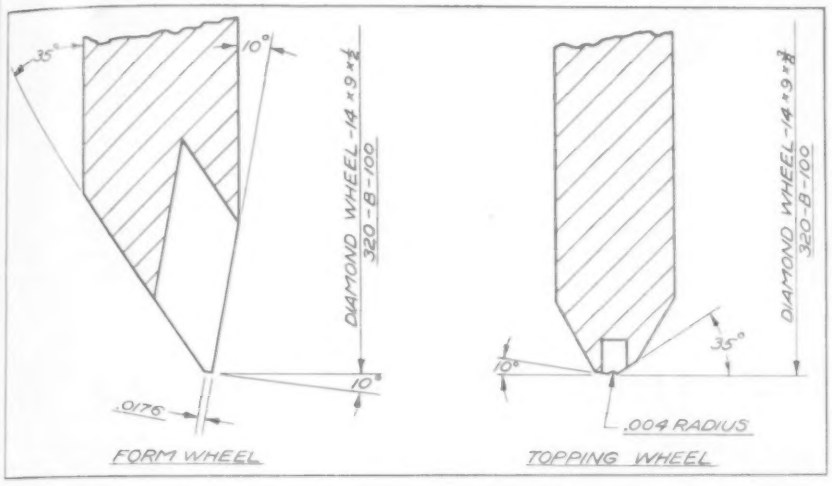


FIGURE 5.

Forms and dimensions of diamond Form and Topping wheels used in grinding carbide-tipped taps.



The grinding-wheel body is dressed true before dressing of the diamond area is started, and a supporting flange on each side of the wire, mounted on the center arbor, is brought into contact with the dressed portion of the wheel to prevent the crushing force from splitting the wheel. The wire used is ordinary music wire. One-hundred-eighty° radii as small as .002" have been dressed into diamond wheels in this manner.

Dressing of the flat on the face of the wheel, which forms the flat required at the root of the tap, is done with a silicon-carbide wheel mounted directly on the spindle of a Miller Falls 10,000 rpm hand grinder. The dresser is passed across the face of the diamond wheel by actuating the machine's table mechanism.

The width of this flat is controlled closely to deliver all thread elements at one time. The entire thread form is ground with a fully formed wheel, rather than one side at a time, to equalize side pressures against the wheel, and to avoid deformation by springing the wheel.

Grinding the 3° hook on the cutting face (Figure 6) is done on a Number 2 Brown & Sharpe surface grinder, in a specially designed index fixture.

The indexing is done to a position limit within .0005" in order to assure that all flutes cut. The hook is rough ground with a 320 Norton diamond wheel and finished with a cast-iron wheel charged with fine diamond powder. The high finish found desirable on the hook face is extended down to the chip-breaker radius at the bottom of the hook.

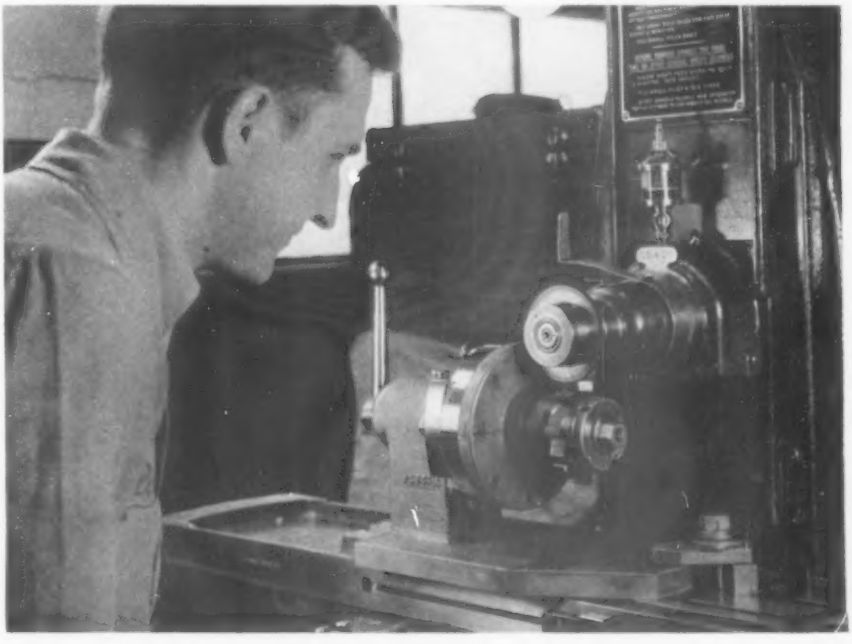
The same fixture used in the face-grinding operation is used in grinding the 30° chamfer on the tap. For the chamfering, an eccentric spindle built around the main spindle is rotated. The tap is rotated by manually moving the lever at the rear of the fixture back and forth.

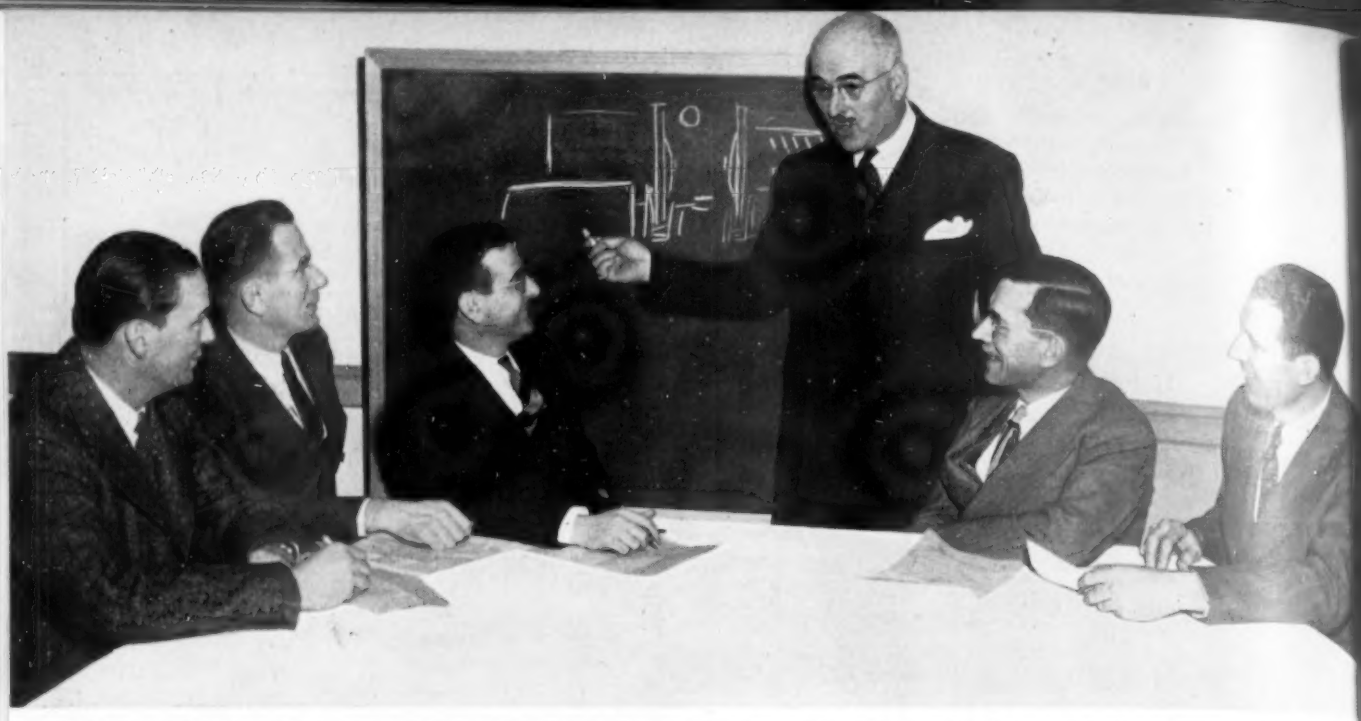
Grinding is done against the face of a 120-grit diamond-cup wheel. Here too, accurate index is important in order that all cutting faces are presented simultaneously to the work.

THE END

FIGURE 6.

Grinding the 3° hook on the cutting face of the carbide-tipped tap is done on a Number 2 Brown & Sharpe surface grinder, in a specially designed index fixture.





Toledo production engineers assembled in the Hillcrest Hotel of that city, April 21, for the first "Production Round-Table" in a nation-wide series sponsored by The Bramson Publishing Company. From left to right: Charles R. Moore, A. E. Lindner, Melvin J. Feak, R. V. Mills, Robert B. Haynes, and K. C. Hoagland. Each represented companies having widely varied production problems.

TOLEDO ROUND-TABLE REVEALS DEMAND FOR IMPROVED MACHINE TOOLS

WHAT will be the postwar machine tool demands of the nation's metal working industry?

Admitting possible requirement of a limited number of war-built excess machines, but pointing to a greater interest in new and improved equipment which builders may offer with the coming of peace, production engineers from six outstanding industries offered a wide range of opinion at a Production Round-Table held in Toledo, Ohio, April 21, by the editors of The Tool Engineer Magazine.

CROSS SECTION OF USERS

Representing a comprehensive cross section of American metal working industry with operations ranging from high production automobile work to heavy, job shop output of oil field equipment, these typical machine tool users estimated the postwar requirements of their industries might vary from 10 per cent in replacements to 50 per cent additional equipment.

All opinions offered at the Round-Table were personal and in no instance were intended to reflect the postwar management policy of the individual companies represented. Nonetheless, the opinions expressed were significant as indications of trends in thinking, for each participant in the long discussion influences the selection and purchase of substantial quantities of metal cutting and fabricating equipment.

The Toledo conference, bringing together production men who will determine the methods and machines to be used when the metal working industry reconverts, is the first of a series to be held throughout the nation by Bramson staff editors.

USABLE DPC EQUIPMENT

Conferees at the initial meeting included: Robert B. Haynes, Master Mechanic, Spicer Manufacturing Corporation; Charles R. Moore, Chief Engineer, Chevrolet-Toledo Division, General Motors Corporation; K. C. Hoagland, Foreman, Heavy Machine Department, National Supply Company; R. V. Mills, General Superintendent of Master Mechanic's Division, Willys-Overland; Melvin J. Feak, Assistant Production Engineer, Electric Auto-Lite Company; and A. E. Lindner, Master Mechanic, Toledo Scale Company.

Ultimate solution of the problem of disposing of an estimated 750,000 war-built machine tools which will be excess equipment when war production ends, it was agreed, will depend largely upon conditions prevailing in metal working industry when it reconverts to peacetime output.

Individual estimates of the quantity of DPC machines each of the industries represented at the Round-Table could use in civilian manufacture ranged as high as 20 per cent of such equipment now installed. Reflecting the tremendous postwar machine tool requirements of the automobile industry, the highest figure was suggested by Mills of Willys-Overland Motors, Inc.

"Whether the sale price of surplus tools eventually is set at 75 cents or 25 cents on the dollar is idle talk and will not materially affect the sale of such equipment," Haynes of Spicer Manufacturing ventured. "Conditions prevailing at the time our industry reconverts will be the determining factor as to whether it is economical to buy this equipment at any price," he said.

Other general factors affecting decision to buy new or excess machines, it was agreed, will be general business conditions, competition between industries, ability of the machine tool industry to deliver new machines, the prices of new equipment and increased quality and rate of output obtainable from the first postwar equipment offered by the builders.

PATTERN FOR RECONVERSION

Without exception, the six production executives agreed that reconversion to peacetime manufacture would follow the same pattern established in conversion to war production. The initial job will call for swinging into production as rapidly as possible, using substantially the same methods as before war, and then undertaking a streamlining of production through utilization of a few war-born developments and many postwar improvements in machining equipment which each will demand in the particular types of equipment their individual industries will require.

PRODUCTION ROUND-TABLE

PRODUCTION ROUND-TABLE

Round-Table consensus visualized a pent-up demand for improved and radically changed equipment developing into a substantial machine tool market soon after industry gets back into peacetime operation.

Reduced to the barest essentials, postwar machine tool demands of the industries represented call for increased output per unit and special equipment engineered for greater flexibility. The inevitability of product design change and variations in production requirements in each shop represented in the Toledo discussion was highlighted by a universal demand for special unit type machines possessing design characteristics that would permit easy conversion to various jobs without the rigidity now inherent in much special purpose equipment.

SPEED CONTROLS DISCUSSED

Though the advantages of speed controls involving electronics and variable speed motors were admitted and, in several instances cited as postwar "musts," the demand was universal for lowered maintenance costs for such equipment. Whether increased output per man with such equipment could compensate for the larger initial investment and higher overhead appeared as factors which will govern their widespread and immediate adoption.

That improvement in machine tools necessarily has lagged behind the war period gains made in the field of cutting tools was pointed out.

CUTTING TOOLS ADVANCE

With relative precision and high production requirements, one conferee said he had been running cutting tools on inadequate machines since war production commenced. Obviously, he pointed out, machine tool builders have been unable to introduce improvements and meet the overall demand for machines during the past three years.

Reflecting the tendency in industry to combine operations in fewer set-ups, Mills of Willys-Overland is looking for equipment that will permit more multiple operations.

"Excess DPC machine tools will find their greatest market in those industries with highly repetitive operations involving few product design changes," he said.

Hoagland, of National Supply, represented the heavy duty, job shop. "We can convert tomorrow with little change in our tooling", he suggested.

OUTLOOK ON SURPLUSES

Nevertheless, he said, many industries, such as his, contemplate new peacetime products which will require higher speeds, lower costs and greater accuracy from machine tools.

Again, Hoagland cited the need for equipment that would permit the grouping of such operations as facing and turning, reducing the overall number of machines needed.

Although citing the advantages of variable speed feeds, he pointed out that maintenance was high and simplification in design was needed to reduce upkeep costs. To dramatize the possible use of such equipment in heavy duty industry, he described a planer mill now handling a 40 ton job, jogging as little as .0005" by instantaneous electronic control.

"I am not as pessimistic about the disposal of the excess equipment overhanging the postwar market as some of our machine tool friends, "Haynes of Spicer said. Representing an industry that normally offers a large machine tool market, Haynes is interested in relatively high production, heavy machining.

Pointing to the wartime devastation of the European metal working industry, he visualized a tremendous demand for machine tools there which the United States can supply from the $2,700,000,000 worth of equipment it is estimated the government will own when the war ends.

"The United States will have to finance the rebuilding of these plants. Such countries as France simply won't have the money," he explained. "Never again" he said, "will we permit China, a nation of some 400,000,000 persons, to do without an industrial nucleus. We could count on establishing in China an enormous industry to siphon off these excess machines."

The types of machines his industry would look for "is anybody's guess," Haynes said. Personally, he expressed dissatisfaction with gear cutting methods. "We are cutting gears just as we cut them 30 years ago," he explained.

Speaking of that large segment of industry which has traditionally expected a machine tool to last years, Haynes said the experience of the last four years has made this type of management generally more receptive to the idea of buying improved equipment as a profit-making business move.

"They have learned for the first time," he said, "that machine tools make the business."

If one concern in any industry buys improved equipment, he explained, its competitors will be forced to make similar investments.

Interested in short run precision manufacture, Lindner, of Toledo Scale, reflected a growing demand for higher precision with material conservation through the removal of less metal.

"I would look for new machine equipment from the standpoint of quality improvement instead of drastic product cost reduction," he said.

That postwar machine tool requirements may be boosted both from the standpoint of quantity and variety was suggested by Lindner when he pointed to the new peacetime products his and other metal working industries may introduce. New products planned by his own company, he said, might demand as much as a 50 per cent increase in the number of machine tools it used before the war. Not over 20 per cent of the additional tools, he estimated, would be from the DPC category.

Moore, Chief Engineer of a Toledo Chevrolet plant which generally turns out truck transmissions, spoke of high production gear cutting requirements.

GREATER TOLERANCES STRESSED

His is a typical General Motors installation equipped with modern machines in good condition. It is doubtful if such a plant will face radical product design changes during the first year or two after reconversion.

"Consequently," he explained, "it would seem that such companies will necessarily wait until machines are drastically reduced in price or can offer really substantial increases in output before it is economically feasible for them to consider investment in new machines."

Citing instances where automatic machines sometimes take one man off an operation and put two on maintenance, he reiterated the demand for specialized equipment possessing a greater degree of flexibility and utilization.

Feak, Assistant Production Engineer of Electric Auto-Lite, said he believed postwar machine tool purchases would be based on the premise that you must "produce a job with the highest quality obtainable at the lowest cost."

Quality demanded by the peacetime product consumer and low cost demanded by both the consumer and management, he said, will force the production engineer to consider any postwar improvements offered in metal cutting equipment.

Feak expressed the opinion that, in an industry such as his, all machine tools are purchased to meet today's problems. "You can't buy machine tools for use 10 years from now," he believes.

"If something is brought out that will obsolete the equipment we are using now," he said, "we must scrap and replace tools purchased only 60 days ago if we are to meet competition and prices."

THE END

ROUND PRODUCTION TABLE

CONTEMPLATING THE FABRICATION of new materials with higher labor costs, production veterans see many changes ahead for machine tools. Great improvements in cutting tools, and the necessity of more machine flexibility are factors that will lead to change in design and create a substantial market for new production equipment.

In this, the first of a series of "Production Round-Table" meetings sponsored throughout the nation by The Bramson Publishing Company, some of the important factors which will guide future machine tool purchases were revealed. It is hoped that these meetings will materially assist the government in its surplus machine tool disposal problems, machine tool builders in gaging future market demands, and production men in appraising their own postwar production equipment requirements.

—THE EDITORS

CAPITAL COMMUNIQUE

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

T. N. SANDIFER

Special dispatch from THE TOOL ENGINEER'S *Correspondent in the nation's capital.*

WASHINGTON

IT NOW appears that agencies dealing with manpower have become sufficiently aroused over the so-called labor Black Market operators, centered in Detroit and other major industrial areas, to try to do something about them. Individual plans of action are being put into execution by War Manpower Commission, War and Navy Departments, Maritime Commission and the National War Labor Board, which are expected to put a check on these operators.

The latter, window-dressed as "engineering firms" that have little claim to the title, have been engaged in such activities as pirating of engineers, toolmakers, and tool designers away from legitimate labor markets, with serious detriment to war industry, and with huge profits to themselves, it is charged.

BLACK MARKET OPERATOR WAGES

As an illustration of the methods of such concerns and individuals, one of them solicited skilled workers employed by a war contractor, inducing them to quit their jobs, hired them at higher wages than they had been getting, and sent them to work in another city. The operator accomplishes such results by reason of his disregard of wage limitations, his ability to offer the worker living expenses that frequently average $48 per week, and his practice of charging the new employer, as in this instance, $6.50 per hour for the workers sent. The worker had been offered $2.10 by the Black Market operator in this case.

In a letter to the Senate's Truman committee, Higgins Aircraft, Incorporated, of which Frank O. Higgins is vice-president, reported that some 40 concerns, which he named, had solicited his company offering to supply it workers, presumably at fancy rates.

HIGGINS' BITTER EXPERIENCE

This concern needed such craftsmen as tool designers, loftsmen, production planners, tool and die makers, template makers, and jig builders, for a particular contract. The maximum hourly rates allowed under the Wage Stabilization regulations in force on the contract ran from $1.30 for template makers to $1.75 for tool designers.

"From the moment that our first airplane contract was announced," Higgins wrote Senator Truman, "we were prematurely besieged with offers from countless engineering service companies throughout the country, to supply engineering talent to us at rates ranging to $4.50 per manhour, which we consistently declined, naively believing that we could avoid this exorbitant expense by direct employment."

The Higgins firm soon found differently. As Higgins said, "It is impossible for us to compete for the services of these men because, for some unknown reason, engineering service firms are seemingly exempt from limitations of the Wage Stabilization Unit and hire men at rates as high as $2.50 per hour, plus a maintenance allowance of $48.00 a week."

Private companies on contracts of course, are restricted to wage limits set by government regulation.

As industry men have protested, such practices add tremendously to the cost of government contracts. From a worker standpoint, it is also pointed out, they are equally detrimental. In the Higgins case, for further illustration, men obtained through such "services" ranged from a small percentage rated as good, to a larger balance characterized as middling or downright poor. Yet, at higher wages, they were working alongside trained and skilled Higgins men allowed to receive only $1.45 per hour, in contrast to the $4.50 which some of the outsiders were being paid.

ESTABLISHED CONCERNS LAUDED

The problem has been, as one official told this correspondent, to separate the sheep from the goats. It is generally recognized that established engineering service firms are rendering, in many cases, invaluable assistance to war industry. The government does not desire to wage a hysterical campaign that will harm legitimate organizations in the field.

One "engineering" firm cited by official report, was found to consist of the operator, a clerk and an office girl. The man operating this office however, was reported to be netting $50,000 per month in what were described as plain Black Market labor operations.

One of the first moves has been to enlist the aid of recognized firms in weeding out the real culprits. In a field in which such companies have literally mushroomed, it is said, some such assistance from industry itself is absolutely necessary.

FUTURE CONTROLS SUGGESTED

In the case of the recognized industry association, the standards for membership would undoubtedly have precluded those fly-by-nights that might have sought admission, and, on the other hand, it is doubtful if many such have even thought of affiliating themselves with any recognized professional group. Obviously, some of them could scarcely stand investigation.

Accordingly, the various agencies concerned plan to move against such outlawed operators as are found within the scope of their own laws and regulations. The plans call for establishing the rates that can be paid workers engaged by a service firm, restriction of hiring privileges, and the exercise of control through their contracts, by the War, Navy, Maritime Commission, and other contracting agencies.

COURT ACTION CONTEMPLATED

While some court actions can be taken, the penalties will depend on the nature of the violations. The National War Labor Board, once its action has brought the wages of the workers involved in such activities under the Wage Stabilization Act, can enforce the penalties provided for violation of this Act.

This move alone is expected to clip the operating capacity of outlaw labor brokers, since they can no longer offer the high wages necessary to draw skilled men away from their regular employment or working area.

The War and Navy departments, and Maritime Commission, along with other measures, have warned contracting firms that " the authority under the Renegotiation and other statutes will be utilized to the fullest extent to disallow exorbitant charges under such contracts" with questionable engineering services, and to eliminate excessive profits arising under this practice.

On another front, the conferences of the newly formed Automobile Industry Advisory Committee with WPB Chairman Donald Nelson, resulted in a cer-

(Continued on page 110)

ENGINEERING CONCERNS ORGANIZE

● DETROIT — Simultaneous with release of news in Washington that action soon would be taken against so-called "engineering firms" charged with dealing as Black Market operators in skilled manpower, announcement was made in Detroit of the formation of the Association of Engineering Companies.

In announcing the new Association, Gerald R. Marshall, Executive Secretary and only paid officer, said the group is a "non-profit Michigan Corporation for the advancement, regulation and general good conduct of the tool and product engineering profession.

"It is not intended," the Association Secretary explained, "that competition be eliminated, prices fixed or trade restrained."

Other officers, all honorary, include: President Marcel Atlas, President, Mechanical Engineering Service Company; Vice President, L. E. Allen, President, Allen Engineering Company; Treasurer, George T. Koch, President, Engigineering Service, Incorporated.

Formation of the organization in the Motor Capital is considered significant, for reputable, long-established engineering firms in this mass production area have suffered substantially in recent months from the effects of several manpower profiteering cases already exposed and prosecuted here.

Shooting the "BIG DUCKS" MILES AWAY

Shooting enemy planes at a distance of several miles is like shooting big ducks on a grand scale. The gunner must "lead" the target to allow for its movement while the shell is getting there.

Hence, the antiaircraft gun is never sighted at what it is trying to kill—but at some point in advance of the target.

The eye and experience of the most expert duck hunter would be of little use in shooting these "big ducks." The pointing of the gun is a complicated mathematical problem, solved by an elaborate plotting machine. The gun must follow orders of this plotting device with utmost exactness.

Without precision of the very highest order in every critical part, the gun couldn't hit the "big ducks." Antiaircraft fire would be mildly annoying instead of having deadly accuracy.

Microhoning contributes largely to this result because it provides the modern production approach to precision in final stock removal—maximum precision control of surface character.

Without this *production* approach to precision, it would be impossible to build these "big duck" guns in the quantities needed.

Some Microhoned Bores in Antiaircraft and Other Ordnance

Rifle Barrel Lands • Rifle Barrel Grooves • Recuperator Cylinders • Regulator Cylinders • Variable Recoil Cylinders • Rifle Hoops • Tapered Gun Chambers . . . (Guns from 2½ feet to 75 feet long—.30 caliber to 16 inch in diameter).

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nothing up his sleeve

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Our free booklet called "The 577th Oil" gets down to cases. Write for your copy.

—CAPITAL COMMUNIQUE—

(Continued from page 108)

tain amount of optimism being generated on the subject of the return of the automobile industry to its normal production. At the risk of adding to some confusion that followed the meeting, as to just what to expect, this department will set out its own report. The sum of this information is that at least six months will be required by the industry to retool, and it will be 1945 before any automobiles are made again. Then they will be the last 1942 models to come off the line, with perhaps some minor adaptations.

An exploring committee was designated to go further into the whole question. However, a considerable part of the discussion revolved around retooling problems (see Motor Memos, page 124).

TOOL STORAGE PROBLEM

WPB officials expressed a view that a retooling program might be acceptable if the new tools merely were stored until such time as the automobile industry can be given a go-ahead.

Advance acquisition of tools, it was believed, might help reduce the time lag between cancellation of war contracts and the date when postwar cars would be seen. The problem of where such equipment might be stored until reconversion was suggested, in view of the fact that factory space currently is at a premium.

There was general agreement that the manpower situation in the auto industry may ease to some extent during 1944, and that some plans should be made to the extent necessary to head off unemployment resulting from war production tapering off.

While this particular phase of the situation is a contribution from this department, and was not mentioned in any of the discussions, the thought is suggested that a factor in the whole outlook is the Fall elections. If there is any risk of unemployment over any considerable industrial area foreseeable at that time, it is a safe prediction that concessions are going to be made on the side of conversion of industry, as a safeguard, without too much regard for any but the most serious objections that might be raised.

MACHINE TOOL PRICES

Following the meeting at Cleveland late in March, of a sub-committee of the Machine Tool Industry Advisory Committee for the Office of Price Administration, it is understood that this group has submitted certain recommendations of changes to be incorporated in the regulations covering manufacturers' sales of machine tools and parts, to Washington.

The changes deal with incorporation of trade terms and language into the regulation, and do not affect price structure. They have been embodied in a tentative draft of the regulation as re-drawn, and were to be considered for approval at a meeting scheduled for April 21.

Meanwhile OPA has amended its regulations on machine tool prices to provide an alternative pricing formula for sale of second-hand tools purchased new after March 1, 1941, to allow for the higher cost of the machine tool in the sale price. THE END

FACTORS THAT ARE IMPORTANT TO BROACH EFFICIENCY!

A broach is a precision tool which requires unusual skill and experience in design plus a special proficiency in manufacturing.

To assure an exceptionally high degree of performance — both in the accuracy of the parts broached and, long life for the broach itself — we suggest that you discuss your next broaching job with an "Illinois Tool" engineer. If you have such a problem now, send us complete details.

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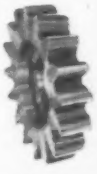
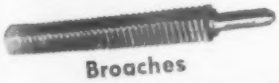

Shaper Cutters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MACHINE TOOLS

. . . news and trends in the Machine Tool Industry . . .

PLANS FOR DISPOSAL

● Excess government-owned machines may total 750,000

CLEVELAND—As the machine tool industry nears inevitable completion of its number one war job—providing the machines necessary for victory on the United Nations' production front—the spectre of a peacetime market glutted with excess machines looms ever larger as a serious deterrent to post-war survival of some builders.

Though no specific official proposal has come from the industry for handling the problem of disposing of at least 750,000 machine tools which may be unneeded in the United States when war production ceases, the National Machine Tool Builders Association itself, as well as prominent individual builders, are known to be united in the belief that such tools should be put to work immediately rather than be scrapped or stored.

Currently faced with the problem of declining sales, while available production facilities mount proportionately and skilled labor slips away, a large segment of builders are hunting for prime or sub-contract war jobs. Though actual machine tool production currently is running at approximately 80 per cent of the industry's capacity, rated in manhours, non-machine tool war work this year will probably pass the $200,000,000 mark.

Despite the fact that the future prosperity of the industry may well hinge on the disposition of surplus machines in the postwar period, builders are prepared only to offer their recommendations when asked for them, as has the Machine Tool Builders Association, and leave the details of any overall disposal program in the hands of the government.

"To formally suggest what we thought the government should do with the public-owned machines we have built," one machine tool man told The Tool Engineer, "would look as though our industry was asking for special consideration. We don't want anyone to get that impression. We turned out 10 years normal production in two or three years because our country was in dire need of the machines. We didn't produce them for selfish reasons."

Yet machine tool leaders say emphatically that surplus machines should not be scrapped, should not be stored indefinitely, and should not be sold at ridiculously low prices.

Thinking on the subject has progressed further than generally believed.

Here is the consensus of opinion, as gathered from industry leaders:

No specific legislation on excess machine tools is expected in this session of Congress, and probably not before the return of Congress in the Fall and pending the outcome of the initial efforts of William L. Clayton, Surplus War Property Administrator.

Clayton has estimated that the value of surplus machine tools at the end of the war will mount to $2,500,000,000, but the majority of these machines will not be in the excess category until after a successful European invasion when the armed services will release them.

The Clayton organization is working hard on the machine tool phase of the surplus war goods problem. Headed by Walter E. Joyce, of the Reconstruction Finance Corporation, its efforts to induce the sale of such equipment now is counterbalanced by the reticence of the armed forces to release machines at this stage of the war.

The National Machine Tool Builders Association has estimated that 2,000,000 machine tools are needed to win the war. Yet, not more than 1,250,000 are needed for prosperous peacetime manufacture.

At the moment, it is up to Clayton to lay the groundwork for disposing of the difference. Two programs are believed under consideration:

1: Sell to the highest bidder in answer to government advertisements for bids. This method, machine tool men say, would be applicable if the disposal problem involved 100,000 machines. It will not work for 500,000 or more units. It leaves the door open, they say, for the speculator to bid low on a huge quantity of machines and all out of line of the real value of the individual units in such a purchase.

2: Apply a discount to the original invoice price of every machine in the surplus stocks, price the machines as they are with no warranty, and limit

(Continued on page 132)

● What is the post-war outlook for the machine tool industry? For the interest of TOOL ENGINEER readers, who are buyers and users of machine tools, leaders in the industry have been invited to present their views of this vital question

A NEW ORDER OF MACHINE PROCESSING TECHNIQUE

KIRKE W. CONNOR
PRESIDENT
MICROMATIC HONE CORPORATION

CONNOR: HONING'S DISCIPLE

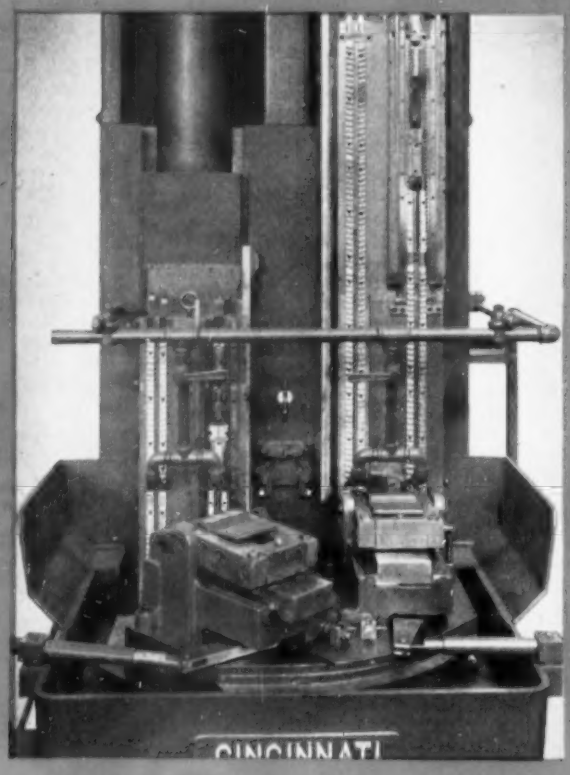
● The machine tool industry, recognized as the mother of all industry is facing one of its greatest opportunities to meet the challenge of accelerating progress. Tremendous production increases, better quality control of finished products in manufacturing industry, and sales of machine tools in reconversion will depend on its willing acceptance of this responsibility.

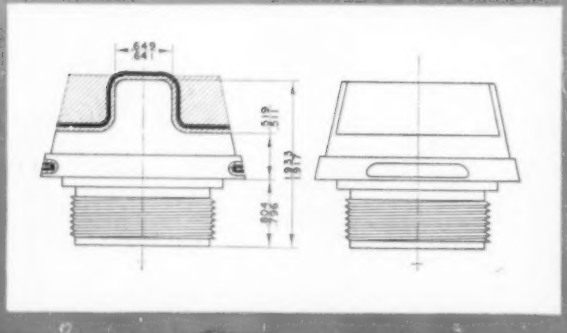
It seems very clear that present concepts of machining and machine tool practice must be largely revised in favor of quicker, better and lower cost processing techniques. It is, for example, definitely wasteful and uneconomic to start with a 70 or 80 pound forging in order to obtain a 7 or 8 pound finish-machined product.

A new trend is evident, comprising new values obtainable by combining new materials with newer and simpler processing. It is now apparent that a substantial amount of machining operation may be eliminated by the use of centrifugal or other forms of pressure casting when using various alloy steels and some non-ferrous metals in combination with some of the newer high production heat-treating methods.

It seems indicated that abrading processes alone will be needed for the complete machine processing of a lot of work parts directly from the casting. This development comprises a new order of stock removal with simultaneous generation of geometric accuracy, uniform size within limits of a few ten thousandths of an inch, and any type or degree of final surface finish in high production.

Present research and development already is sufficiently complete to warrant the promise of its commercial availability as quickly as present manufacturing facilities are released from war production requirements.





CINCINNATI No. 5-42 Duplex Hydro-Broach machine. Complete data may be obtained by writing for catalog M-894-2. A number of interesting case histories of CINCINNATI Hydro-Broach applications may be obtained by writing for folder M-1207.

DEEP-CUT BROACHING

Multiplies Depth of Cut by 4

Many new ideas for the machining of metals, tried and proven in the production of war material, must be considered in planning manufacturing methods for new products. Broaching machines, for example, ordinarily remove up to 5/32" stock, while greater amounts are within the fields of other machines.

Nevertheless, the ingenious tooling on the machine illustrated at left... a CINCINNATI No. 10-66 Vertical Duplex Hydro-Broach... makes it possible to remove 5/8" depth of stock and maintain a high rate of production at the same time.

Two parts are held in each fixture. The total depth of cut is obtained progressively by transferring the part from one side of the fixture, where it has been roughed, to the other side of the fixture, where it is finished. During the finishing cut two wrench slots are also broached. This arrangement produces one finished part each stroke of the ram (two parts per machine cycle).

Our engineers will be glad to apply their knowledge of broaching to your machining problems of today and tomorrow. Send blue print of part and full details with your request.

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INDUSTRIAL NEWS DIGEST

. . . a review of significant developments and new techniques in mass production industries . . .

MAGNESIUM ASSOCIATION

● Producers and fabricators to disseminate technical data

CHICAGO—To foster the development of magnesium alloys fabricating techniques, producers and fabricators of these metals have formed The Magnesium Association.

Chief purpose of the organization, it was announced, will be to give members and the public information on the properties and advantages of magnesium alloys, as well as suitable applications.

Edward S. Christiansen, Vice-President, Apex Smelting Company, was elected President of the Association at an organizational meeting here. C. C. Loomis, President, New England Lime Company, was named Vice-President, and C. E. Larson, Operations Manager, White Metal Rolling and Stamping Company, was elected Treasurer.

Temporary offices of the Association are located at 2537 W. Taylor Street, Chicago 12, Illinois.

Association membership is representative of all phases of the magnesium industry. Four major groups are represented: Producers and smelters of ingots; sand, permanent mold and die casters; wrought products; and magnesium powder manufacturers.

Provision has been made, according to Association officers, for technical and consumer group committees which will concentrate on operations and uses which can be better served through the use of magnesium alloys. Exhibits of articles fabricated from magnesium are planned as part of the Association annual meetings. The public will be invited to these exhibits, it was said.

Significance of the new organization is indicated by the fact that today there are more than 100 concerns engaged in the fabrication of magnesium and its alloys, using such methods as drawing, forging, rolling, extruding, sand casting, permanent mold and die casting and powder manufacture.

(See The Tool Engineer magazine, March, 1944).

POSTWAR WELDING

● Railroad builder predicts increased use of technique

CHICAGO—Predicting that welding will be used extensively after the war to build lightweight box cars, Wallace N. Barker, Vice-President, Pullman-Standard Car Manufacturing Company, states that this production technique will save up to 20 per cent in weight and increase railroad payloads correspondingly.

"In the welding which we will do in the postwar period we will make use of our experience in manufacturing war products, just as, when getting into war work, we drew upon our peacetime know-how in making welded railway equipment," he said.

It will take years to replace the railroads' 1,700,000 over-age heavyweight freight cars, but such a program is expected to begin immediately after peace is declared, Barker said.

"For approximately the same investment," Barker said, "a railroad can lop off more than three tons of dead weight in a car that is as strong as, if not stronger than, the heavy riveted car, and savings of as much as four and one-half tons are possible. With the average box car weighing between 22 and 23 tons, this represents a saving in weight of from 13 to 20 per cent."

Pullman-Standard, whose engineers have won five national awards for welding research in the last three years, are credited with pioneering numerous

(Continued on following page)

WOMEN AND MACHINES

Vertical broaching machine on war production in a Chevrolet plant. Women now constitute 35 per cent of the company's working force, number 60 per cent in some of its plants.

Described by some automotive production men as "the most modern form of machining," broaching is replacing milling on numerous production jobs.

At the Toledo transmission plant of General Motors' Chevrolet Division, this woman worker operates a vertical dual-ram surface broaching machine, broaching the front face complete of the universal joint flange for military vehicles.

Since each of the two broaches is 60" long, the operator stands on a platform to feed the work into the broach face.

"GREENIE" *Returned From the Shelf*

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

WE HAD TO HIRE OLD ALEC — IN FACT, CONSIDERING THE MANPOWER SHORTAGE, WE'RE MIGHTY LUCKY TO PERSUADE HIM TO COME OUT OF RETIREMENT!
MAYBE SO, BOSS — BUT WHERE'S THE PERCENTAGE? FIRST THING YOU KNOW TWO OTHER MEN WILL BE NEEDED TO HOLD THE OLD-TIMER UP ON HIS FEET!

(Continued from preceding page)

welding methods. The company adopted the technique in 1911 as an adjunct to mass production of steel passenger cars.

Barker declared that welding will not completely eliminate riveting in Pullman-standard production. All fabricating methods, he said, have their particular place in mass production.

SURPLUS MATERIALS

● Air Corps announces expansion of successful disposal plan

DAYTON, OHIO—Wartime utilization of surplus material in aircraft contractors plants is being accomplished on an expanded basis by the Army Air Forces Materiel Command through broadened operation of the Aircraft Scheduling Unit.

Objective of the Aircraft Scheduling Unit is to insure the use wherever possible of existing material while the need for it still exists. Much of this material would probably have no place in a peacetime economy and must be employed in war production or scrapped later.

In furthering its purpose, the ASU operates through the Materials Distribution Branch of the Production Division, Materiel Command, at Wright Field.

Indicative of the operation of the program are weekly meetings in Los Angeles where Army Air Forces Western Procurement District, in conjunction with representatives of Western aircraft companies, study lists of idle surplus materials and current production requirements.

Production requirements are screened against available surplus materials with the result that thousands of dollars which ordinarily would be spent on new procurement are saved by the use of existing stocks. On the East Coast, a similar program is under way.

Two objectives are accomplished by the program: Material which would normally lie idle is used in production and maintenance; and, the cost of procurement is greatly reduced.

The Materials Distribution Branch of the Materiel Command is kept advised of authorized civilian production by the War Production Board, and with this information is in a position to open new markets for materials for which aircraft contractors' needs have diminished.

The ASU expects this plan, although limited at present to inter-contractor transactions, to help alleviate the problem of conversion.

MATERIALS DISPLAYED

● WPB displays aircraft material and equipment now available

NEW YORK— Foreshadowing the eventual disposal of tremendous quantities of excess materials from the aircraft production program, sample items from such inventories of large East Coast plane producers were displayed for sale here last month.

The exhibition, held by the New York office of the War Production Board, included more than 5,000 items, including perishable tools, industrial supplies, materials and parts.

While many uses of the items now offered for sale through the WPB are subject to government control, WPB is offering prospective purchasers all necessary assistance in securing proper authorization for use.

Many of the items shown in New York and soon to be available through other Regional WPB offices are usable in war production and essential civilian manufacture.

ASME SPRING MEETING

● Engineers warned of critical period ahead, hear 30 papers

BIRMINGHAM, ALA.— Devoting their attention to technological problems related to war production, and hearing more than 30 technical papers and addresses, members of the American Society of Mechanical Engineers gathered here April 3-5 for their annual spring meeting.

Warning that the next 12 months will be the critical period of the war, Robert M. Gates, president of the ASME, said that the "big push" in Europe and the Orient "will be no parade for us to watch and cheer from distant sidelines."

Praising the role engineers have played in the victory on the production front, Gates predicted that after the war more engineers will be needed than ever before, both in the United States and throughout the world.

Among the technical papers presented and of interest to metal working production men was one by Axel Lundbye, Chief Engineer, Crowell-Collier Publishing Company, who described the chromium plating method for cutting tools.

By plating with chrome, he said, and subjecting to an after-treatment of soaking in hot oil at 350° F. for an hour, cutting tool life has been extended as much as 50 times. The process, which has been described in The TOOL ENGINEER magazine has been made available to industry by the publishing company.

Cold treatment of metals—80 to 130° below zero—was described by G. B. Berlien, Chief Metallurgist, Lindberg Steel Treating Company. Substantial

(Continued on page 118)

DESPITE READJUSTMENTS, THE FUTURE OF THE INDUSTRY LOOKS GOOD

No segment of American industry deserves more credit than cutting tool manufacturers for the victory we have achieved on the production front. Likewise, future trends in mass production metal working are contingent on wartime and postwar developments in cutting tool design and materials. Here is another in The Tool Engineer magazine series on the postwar outlook from the viewpoint of prominent cutting tool producers.

" . . . still others will be lost in the field of competition . . . "

J. A. SCULLY
SCULLY-JONES AND COMPANY

FUTURE means time yet to come—now until infinity. The future of the tool industry cannot, therefore, be regarded only as the period immediately following the termination of the present conflict or the discontinuance of Government orders.

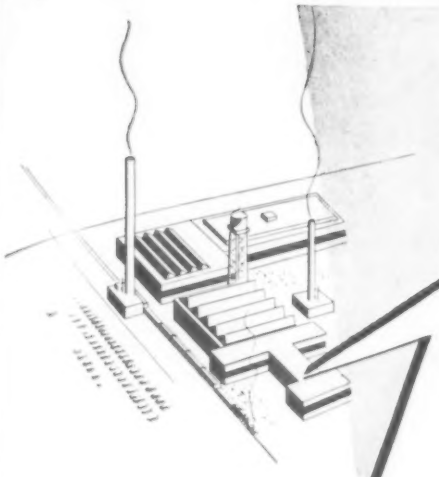
Although many tool manufacturing concerns have expanded greatly as a result of wartime demand, the expansion has been in the same lines they were following in prewar times and the return to normal output will be relatively easy.

Under the impetus of war, many new plants were built and many new trade names have appeared in the tool manufacturing field. Whether all can survive is probably what is meant by the "Future of the Tool Industry."

When we are again geared to peacetime production, no doubt many present day tool manufacturers will elect to resume their prewar lines of endeavor. Still others (and not necessarily the newcomers) will be lost in the competition.

Readjustment in the tool industry will inevitably follow the return of peace. The "Future" of the industry, however, in this great mechanical age is a certainty. Out of the cauldrons of war, the inventive genius of creative man will again convert swords into plowshares on a scale unprecedented in the history of the world.

The future of the tool industry looks good.



"The lathe had to be good enough for today and for years to come. —Checking them all, our choice was an L & S"

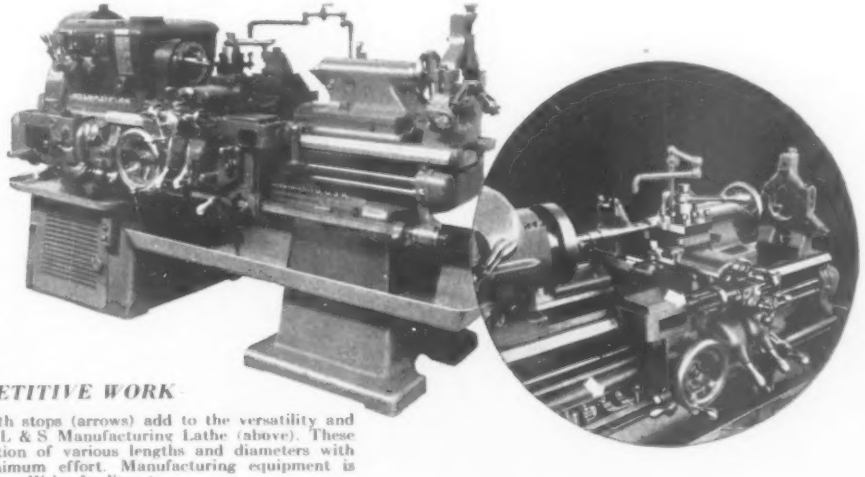
A GOOD lathe, properly handled, can last a long time . . . even several decades. Over many years, however, important changes occur. Cutting tools are improved. Newer metals and alloys are developed. Higher speeds are required. Automatic features are introduced transferring skill from worker to machine. All of which brings up the question: how versatile, how well adapted will your lathe be to meet such changing factors in years to come?

When considering lathe values and likely future requirements, you'll find it pays to look into an L & S. Fifty-two years of *continuous manufacture of lathes only* has resulted in what we call "engineering foresight" . . . a specialized ability to make lathes unsurpassed in profitable performance year after year under changing conditions, with maximum efficiency and accuracy.

For a practical demonstration as to how "engineering foresight" can help your production—today and in years to come—call on Lodge & Shipley Engineers.

Prepare for the Coming Battle of Markets!

Someday—perhaps sooner than expected—you'll resume production of pre-war goods. When that day arrives, you'll want no delay or top-heavy costs. Plan now with L & S Engineers for profitable lathe performance. Be ready for "Re-Conversion" Day!



CUT TIME ON REPETITIVE WORK

Multiple diameter and length stops (arrows) add to the versatility and productive capacity of the L & S Manufacturing Lathe (above). These stops permit rapid duplication of various lengths and diameters with extreme accuracy and minimum effort. Manufacturing equipment is available for all sizes of lathes. Write for literature.

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TOOL ROOM
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LATHES

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L & S LATHES

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Woody Spencer says:

"W. & S. Taps today embody the same high ratio of quality and precision that has made them an established choice. For operations requiring maximum tapping accuracy, specify Wood & Spencer.

Write today for our recommendations on your particular jobs. Catalogs sent on request."

"THE RIGHT TAP AT THE RIGHT TIME"

The Wood & Spencer Company

Cleveland 3, Ohio

INDUSTRIAL NEWS DIGEST

(Continued from page 116)

increases in tool life can be obtained by this process, he said. The method has been described in this magazine.

A study of the advantages of work simplification in the steel industry presented by A. H. Roosma, Assistant District Manager, Southern District, Republic Steel Company, found wide interest among attending engineers. Showing the fallacy of the argument that "it is all right for some other plant, but it won't work here," Roosma described new methods that did work.

GEAR PRODUCTION

● Gear Manufacturers Association reports sales decline

PITTSBURGH — For the second month, volume of sales for the gearing industry showed a decrease with a drop of 13 per cent in February business.

The figure was compiled from reports of members of the American Gear Manufacturers Association and does not include turbine or propulsion gearing, it was said. The index figure for February, 1944, was set at 214.

TOOLS AND DIES

● Association announces first national convention plans

WASHINGTON—Ben Buerk, President, Buerk Tool Works, Buffalo, New York, has been named by the National Tool & Die Manufacturers Association as its National Counsellor to the United States Chamber of Commerce.

The announcement was made by M. W. Rowell, Association General Manager and former Chain Belt Company executive. Buerk is a director of the Association and will represent the organization at the Chamber of Commerce Convention, New York City, May 2 and 3.

The Tool and & Die Association will hold its first convention in Buffalo, September 28-30 inclusive, Rowell has announced.

L. A. Sommer, President, Sommer and Adams Company, Cleveland, is President of the Association, which was organized in September last year.

AIRCRAFT PRODUCTION

OVER THE TOP

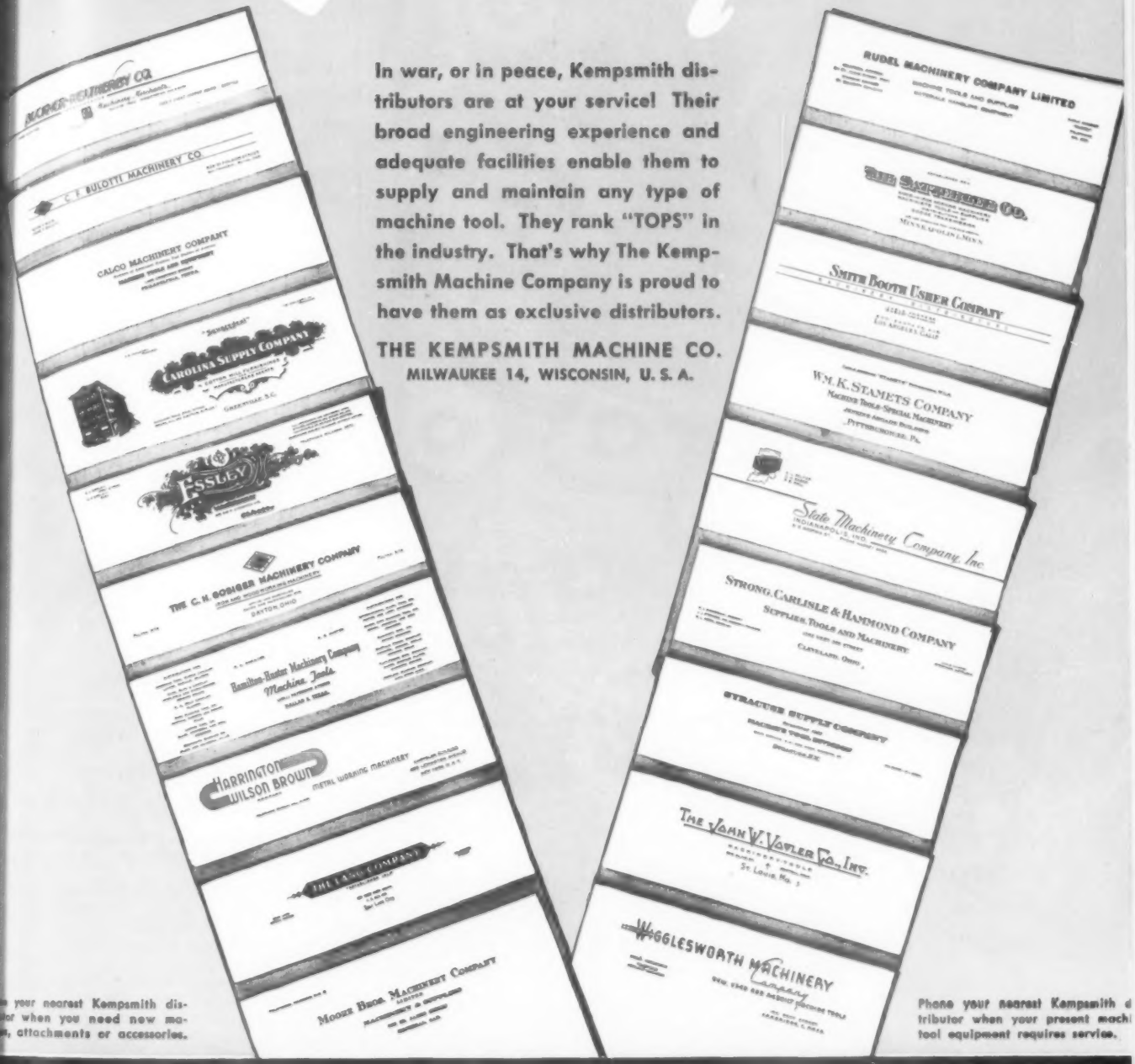
● Willow Run hits promised bomber-an-hour goal

DEARBORN—Climaxing a two-year goal promised by Henry Ford, production of one huge four-engine bomber every hour has been realized at Willow Run.

The production program at the much maligned Southern Michigan aircraft plant hit its stride last February, seven months ahead of schedule, the Army has permitted Ford engineers to reveal.

(Continued on page 120)

... to serve you now and after Victory!



In war, or in peace, Kempsmith distributors are at your service! Their broad engineering experience and adequate facilities enable them to supply and maintain any type of machine tool. They rank "TOPS" in the industry. That's why The Kempsmith Machine Company is proud to have them as exclusive distributors.

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... your nearest Kempsmith distributor when you need new machines, attachments or accessories.

Phone your nearest Kempsmith distributor when your present machine tool equipment requires service.

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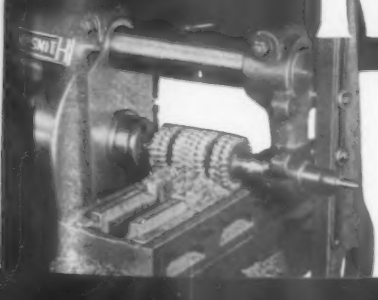
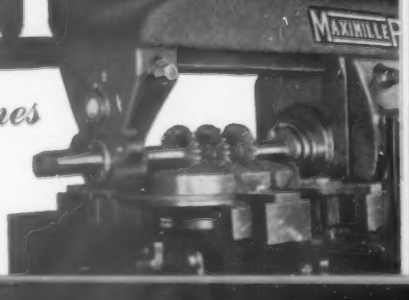


TYPE "G"
"Brother" of the famous Kempsmith Maximiller.



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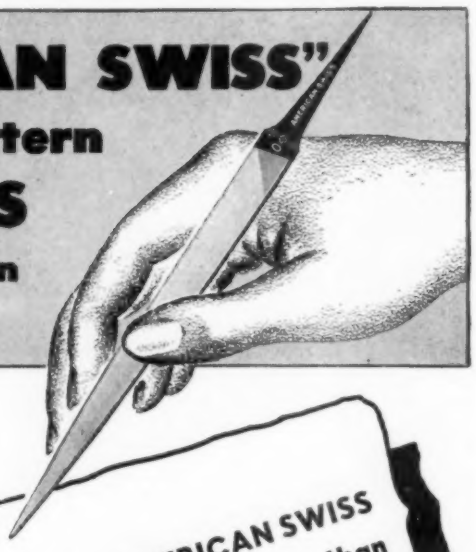
Rugged, heavy-duty, high speed milling machine.

"AMERICAN SWISS"
Swiss-Pattern FILES
write their own testimonials



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"Our experience has shown that AMERICAN SWISS Swiss-Pattern Files last at least 25% longer than others"

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Long life in a file is the result of tough, strong metal . . . correct and uniform hardness . . . sharp, accurately cut teeth . . . long filing surface. All these features are characteristic of AMERICAN SWISS Files . . . as proven by their popularity for almost 45 years.

AMERICAN SWISS Swiss-Pattern Files have always been made to only one standard . . . the best. There are no "second-quality" AMERICAN SWISS Files . . . each one you buy is guaranteed to be perfect in every respect. These precision tools are made by long-experienced specialists, to exacting standards, and with automatic controls and close tolerances.

These are some of the reasons why it will pay you to standardize on the large line of AMERICAN SWISS Files for all your precision and intricate filing work. Our Distributor can supply you.

American Swiss File & Tool Co., Elizabeth, N. J.

ASK FOR THEM BY NAME

American Swiss ★✚★

SWISS PATTERN FILES

INDUSTRIAL NEWS DIGEST

(Continued from page 118)

"In January the War Department permitted us to announce that a production rate approaching 450 bombers a month has been achieved, and that the bomber-an-hour goal was in sight. Now it can be revealed that in the first quarter of 1944 we built more bombers than had been produced from the time the ground was broken up to last October," a Willow Run official said.

The third anniversary of groundbreaking for the Willow Run plant was observed April 18.

In addition to handling 85 per cent of manufacturing and assembling of Ford-built Liberator bombers at Willow Run, the plant also produces 85 per cent of emergency spare parts and 50 per cent of normal spare parts.

At the close of March, Ford announced that more than 3,000 planes had been built at Willow Run, 2,000 of which were completed there for flyaway to the battlefronts. The remainder were shipped knocked-down for final assembly in other U. S. plants.

NEW BOEING JOB

● Seattle retooling under way for new Super-Fortress

SEATTLE—Production of the famous B-17 Flying Fortress has been completed in the Seattle plants of Boeing Aircraft Company, and conversion of facilities now is under way for manufacture of the Army's new B-29 Super-Fortress.

Philip G. Johnson, President of Boeing, in making the announcement, said the conversion work will be accomplished over a period of several months. There will be no shutdowns or layoffs, he said.

Douglas Airplane Company and Lockheed Aircraft Corporation will continue to produce the B-17 under a cooperative plan with Boeing. The Wichita, Kansas, and Renton, Washington, plants of Boeing already are devoted to the Super-Fortress job.

RETOOLING AT OMAHA

● Martin-Nebraska undertakes production of new B-29

OMAHA—Retooling operations are nearing completion for the production of the B-29 Super-Fortress at the Martin-Nebraska Aircraft plant here.

J. T. Hartson, President of the Company, announced that the last B-26 Martin Marauder, for which the plant originally was tooled, left production line in March.

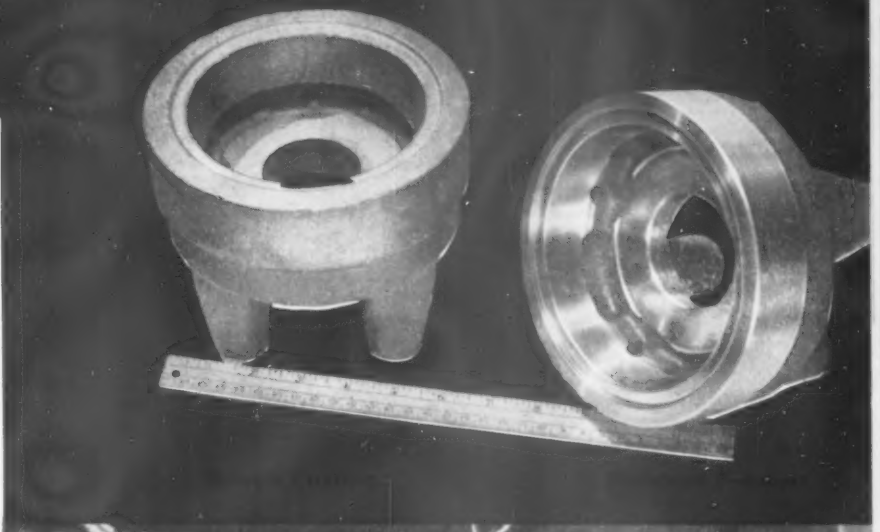
MACHINE TOOL DESIGN

● Bailey Meter produces new contour control system

CLEVELAND—Foreshadowing substantial improvements and design changes in postwar machine tools a new Contour Control employing the principle of the precision air measuring gage to obtain extreme accuracy in

(Continued on page 123)

70% Cost Reduction



THE DAY IS COMING closer when "How much does it cost?" will be a more important question than "When can you deliver?"

The new Acme-Gridley Multiple Spindle Chucking Automatics are built to produce metal parts at lower costs than industry has yet seen.

Take for example the part shown here.

Two Acme-Gridley six spindle chuckers replaced 20 machines in finishing this part and cut the machining costs per piece more than 70%!

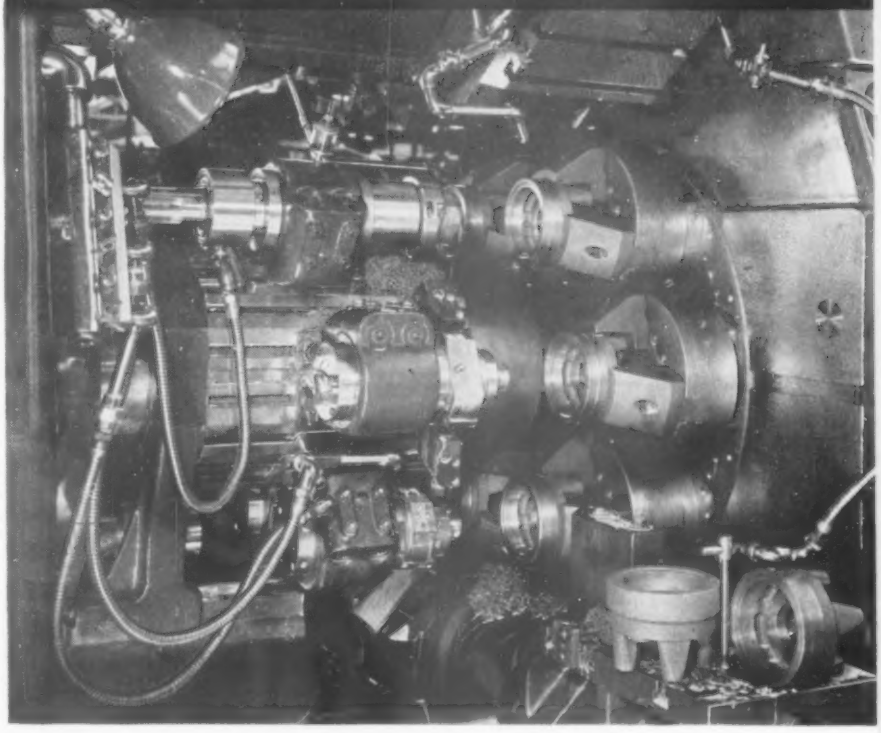
Similar savings have been made by Acme-Gridley Automatics—both Bar and Chucking—on thousands of machine operations.

Production costs like these will be the basis for the new low selling prices certain to be necessary in the highly-competitive markets ahead of us.

If you have chucking jobs to do, be sure to read new bulletin CM-43.

. . .

Acme-Gridley Automatics—4, 6 and 8 spindle—Bar and Chucking—give you precision work at speeds and feeds as fast as modern cutting tools can stand.



This 12" RPA six spindle Acme-Gridley Chucker is tooled for 18 separate operations. Job finished in 1/5 the time required by former machining methods—saving equipment, tooling time, power and floor space.

THE NATIONAL ACME CO.

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ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

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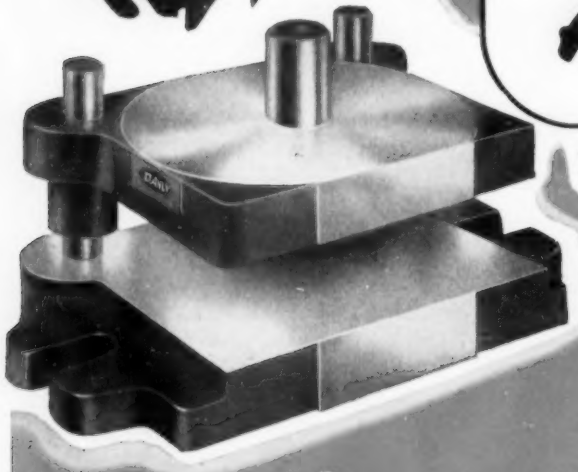

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Precision finish of every part in Danly standard die sets makes possible Danly National Assembly. The resultant perfect fit saves you time and money through faster setups and longer, trouble-free operation.

Absolute standardization is assured.

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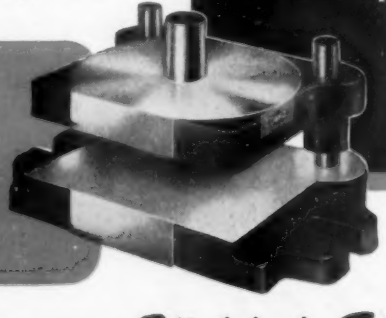


DIE MAKERS SUPPLIES • *Welded Steel Fabrication*

(Continued from page 120)

the automatic operation, has been developed by Bailey Meter Company.

The new setup, previewed before the trade press, employs a pneumatic system which scans a thin metal templet and controls hydraulic cylinders which position the cutting tool or the work with relation to the tool.

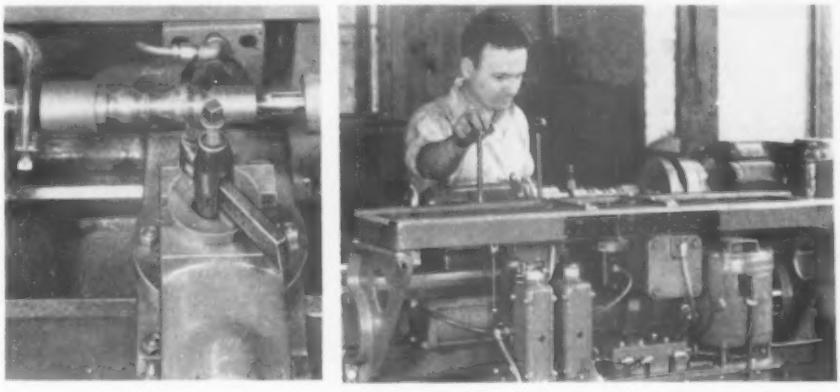
Convincingly demonstrated was the ability of this control to turn, bore and face automatically to exact contours of the templet used to guide its operation. Accuracy of repetition is within .0002 inches and surface smoothness is limited only by factors other than the control. When both the tool and the templet have been properly ground and honed, the control will operate an engine lathe to produce a surface smoothness of 60 micro-inches.

Contours may include slow and fast tapers, round corners and square shoulders. All diameters and shoulders of a step shaft may be turned with one setting of the tool. Difficult contours formerly requiring the use of special forming tools may be turned with one setting of a simple tool.

The extreme accuracy of this new control is secured by using the air control system as an amplifier of motion and a source of power in transmitting the movement of the tracer stylus to the hydraulic control system.

Motion of the hydraulic pilot is from 25 to 100 times greater than that of the stylus depending upon the rate of the spring used in the hydraulic pilot valve assembly. A fully balanced air pilot valve permits operation of the tracer stylus with from 3 to 8 ounces of force. This permits the use of a soft metal templet.

The tracer design, which is based on the regulation of an air flow to create a back pressure, permits minute measurements within a few thousandths of a second. Employing the principle used by precision air measuring gages, it regulates the air flow by stylus position instead of by the size of the piece being measured.



Bailey Meter Company photos

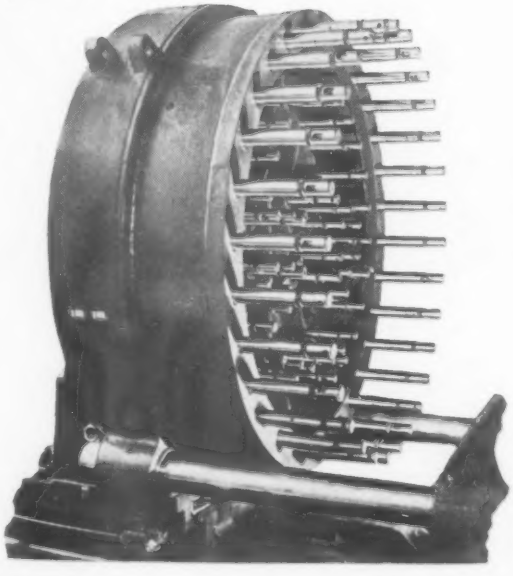
Foreshadowing things to come in postwar machine tool design is a new automatic contour control system developed by the Bailey Meter Company, Cleveland. At left is the operator's eye view showing work, templet, tracer and hand controls. The installation on a 12" Hendey Lathe is pictured at the right.

Bailey Contour Control was originally developed for use in the Company's shops where it is necessary to make flow meter parts which match the contour of specially calibrated master parts. This operation, formerly requiring skilled machinists, now is performed automatically by the new control. Several of the original models have been in operation for over three years continuously making precision parts, Bailey engineers said. The new system will be marketed.

(Continued on following page)

Buhr

A GOOD NAME TO REMEMBER



WHEN you have a tough drilling job.

WHEN you need retooling drilling equipment.

WHEN you need multiple spindle drill heads.

Typical example of Buhr Engineering is this 82 Spindle Buhr Horizontal Tapping Head for tapping 5/16 and 3/8 dia. holes. This is the right hand head of a rebuilt 2-way Hydraulic Horizontal Machine.

Send blueprints for suggestions and recommendations.

BUHR MACHINE TOOL COMPANY

ANN ARBOR MICHIGAN

(Continued from preceding page)

MOTOR MEMOS

Will passenger cars be built this year? Washington says "no", but industry begins groundwork on reconversion plans, calls machine tool builders

DETROIT—The big question that auto industry production men, parts suppliers, machine tool builders and Johnny Q Public have been asking for months was answered in Washington, April 17.

Will passenger cars be built this year? The answer is "no".

Seventeen representatives of individual automobile manufacturers, the very top men from GM, Ford, Chrysler, Studebaker, Nash, Packard, Hudson, Willys and Crosley, were told by the War Production Board that even limited conversion was out of the question until either Germany or Japan was knocked out of the war.

On the other hand, the motor makers told the government that the industry was united in refusing to undertake auto manufacture unless an annual production quota was set at 2,000,000 or more units. And, a WPB-sponsored suggestion for manufacturing a standardized model by one firm as a temporary expedient was turned down by the builders.

Though the auto makers have repeatedly warned that widespread unemployment in auto plants and related industries is inevitable unless reconversion plans are undertaken before war production shifts cause further dislocations, the WPB turned a deaf ear, sent the executives homeward with a suggestion that they return to Washing in 60 to 90 days.

What the meeting, momentous in its economic implications, means to production men interested in any of the multitudinous phases of automobile manufacture can best be judged by highlighting the few concrete developments which resulted.

In two or three months, another meeting is to be held when the nine auto companies will tell WPB what the "practical minimum number of cars" may be that each can make and stay out of the red; what each will need in the way of machine tools, factory floor space; what government-owned tools must be removed, and what percentage of government-owned tools can be utilized for passenger car production.

Reports are to be based on (1) curtailed production, and (2) unrestricted output.

GM President Charles E. Wilson, who has led the industry as spokesman in its plea for an opportunity to "at least prepare for reconversion", pointed out to the WPB that it is as easy to retool for large production as it is for limited production.

Though Studebaker's Paul Hoffman strung along with the "big three" in suggesting that the initial production quota be set at one-half 1941 output, Willys and Crosley objected that such a figure would cause them to operate in the red if they wanted to stay in the business.

WPB, it was reported, offered a guarantee that such firms as Packard, whose war work on aircraft engines will hamper substantial reconversion of its facilities until both Axis powers are eliminated, will be protected by rigid control of materials. Loss of competitive position through inability to get a car on the market along with other concerns is a fear that haunts several companies.

How important machine tools are in any consideration of reconversion to auto building is suggested by the fact that one half of the Washington conclave was devoted to this subject.

To get into any production, it was said in the meeting, some plants probably will have to remove 60 to 65 per cent of existing machinery. Others, it was explained, should be able to get back into production with a much smaller percentage of new machinery.

The most startling fact revealed by auto big-wigs was their contention that not more than 15 to 25 per cent of the government-owned machines now used for war production in their plants can be converted to civilian use.

Washington approval or not, the motor makers refuse to let the grass grow under their feet. The rustle of blue prints in plant engineering and product design departments attests to the rebirth of interest in competitive manufacture.

More and more frequently, machine tool builders are being consulted on tool design—and not for war production equipment.

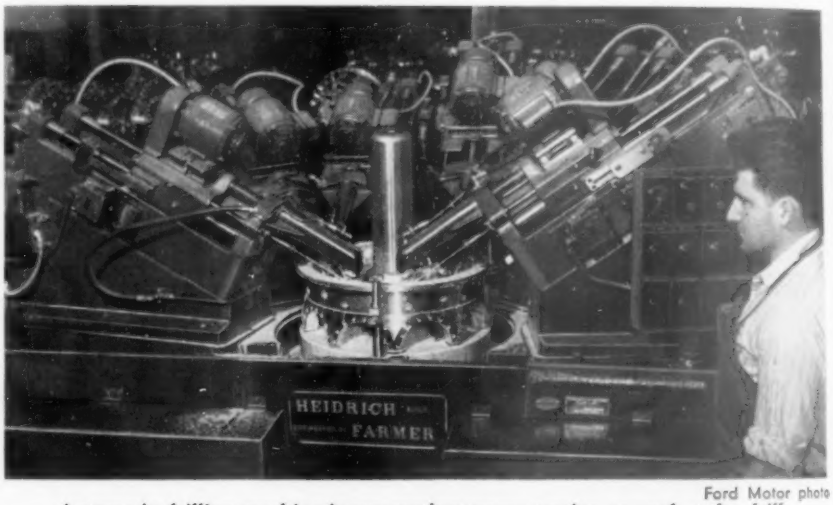
Late in April, it has been learned, representatives of 40 outstanding machine tool builders visited Detroit where production men from General Motors plants throughout the nation announced their postwar production requirements.

No publicity stunt, this meeting was down to earth business with the country's largest single consumer of machine tools offering regular builders an opportunity to meet GM design and production requirements.

The alternative? GM might produce some of its own machine tools.

(Continued on page 126)

AUTOMATIC DRILLING SPEEDS ENGINE OUTPUT



Ford Motor photo

Automatic drilling machine incorporating torque tension control at the drill. The unit was specially engineered for Ford Motor.

DEARBORN, MICH.— Substantial reduction in time necessary to drill the front and rear crankcase sections of the 2,000-horsepower Pratt and Whitney engines has been achieved by the Ford Motor Company through the use of two torque tension control deep-hole drilling machines.

Built to the auto maker's specifications, these machines drill 18 holes in three minutes, an operation formerly requiring 15 minutes on a conventional drill press in the Ford Aircraft building.

The machines are said to be the first to incorporate torque tension control at the drill, thereby reducing drill breakage to a minimum. The principle of the machine is the amplification by electronics of the torque load variations of an electric motor.

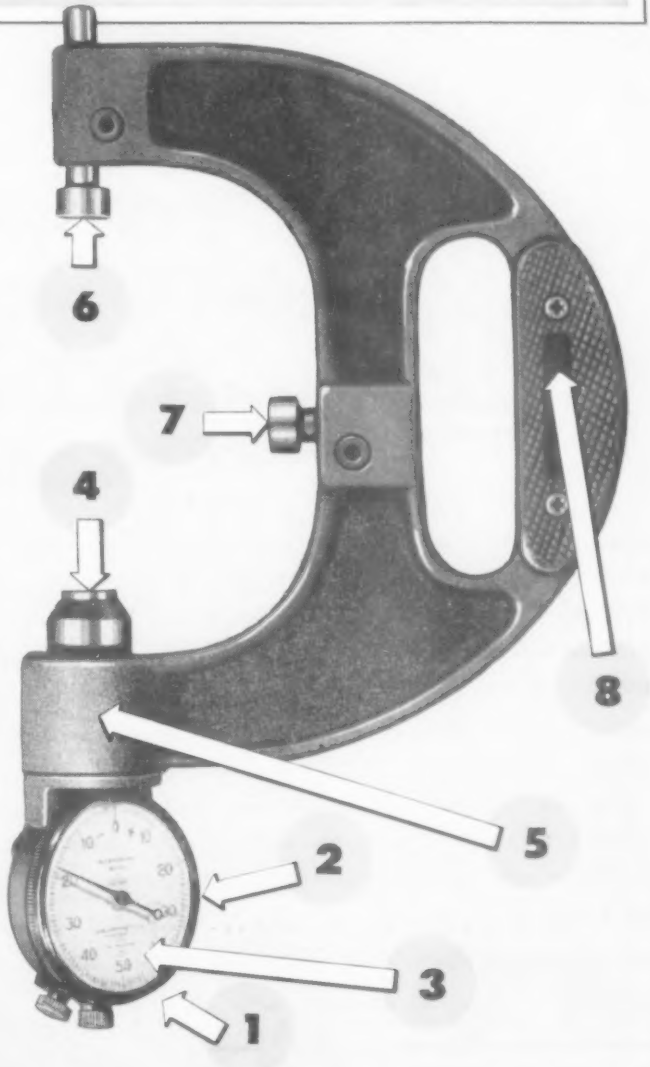
Torque control is incorporated into each of the machine's six heads. Each operates independently, advancing until excessive torque force is applied to the drill either by undue pressure or accumulation of chips in the drill flutes.

The unit then operates a relay which in turn actuates a solenoid-operated hydraulic valve, causing the head to return to the starting position. From this point it returns in rapid traverse to the position at which it encountered the excessive torque. This function continues until the hole has been bored.

SHEFFIELD

DIAL INDICATOR SNAP GAGE

FOR INSPECTION AND CLASSIFICATION



1 Gage may be used with dial either at the bottom or the top, whichever is more convenient.

2 Dial is adjustable radially and can be swung through 360° to facilitate reading.

3 Scale has a range of .005"—each graduation .0001".

4 Movable anvil is spring urged for constant gaging pressure, but spring has no effect on indicator. Special spring pressures available.

5 Movable anvil bearing is long enough to preserve alignment with the fixed anvil.

6 Fixed anvil is adjustable to a maximum of one inch.

7 Adjustable backstop has a cylindrical face for accurate line contact.

8 Comfortable handle with plastic grip to insulate gage from heat of inspector's hand.

Work may be gaged to the accuracy of a one "tenth" indicator without removing it from the machine.

THE SHEFFIELD CORPORATION

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MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES

Dead plants have no problems. They have no war contracts, no cancellations, no conversion worries and, of course, *no future!* Problems are the mark of an aggressive, healthy business . . . and progress is made when problems are considered a challenge that must be met immediately!

Many firms are turning to Pioneer for assistance in meeting the rapidly changing conditions . . . Pioneer *designers* are helping with war products . . . Pioneer *engineers* are handling plant modernization programs . . . Pioneer *trouble-shooters* are taking the kinks out of production and are stream-lining cost systems.

The Pioneer team . . . or any part of it . . . stands ready to serve. Just write, wire or phone for full information.

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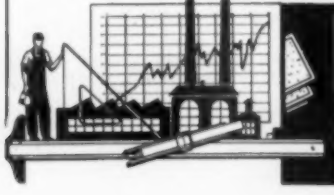
No Job Too Big—No Job Too Small



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19645 JOHN R STREET • DETROIT 3, MICHIGAN

INDUSTRIAL NEWS DIGEST

(Continued from page 124)

INDUSTRIAL BUSINESS NOTES

INDUSTRY REPORTS

Completion: 73 Liberty ship engines under order at the Iron Fireman Manufacturing Company at Portland, Ore., when fire destroyed the plant, will be built by The Joshua Hendy Iron Works, according to the Maritime Commission.

Following the fire, Iron Fireman's contract was cancelled, with 312 out of 389 engines contracted for, delivered. Filer and Stowell Company, Milwaukee, will complete four of the engines. Uncompleted parts from Iron Fireman will be assigned to the two takeover companies.

* *

Moved: The Evans Reamer and Machine Company, Chicago, to new and larger plant facilities at New Lexington, Ohio. It is expected that the enlarged production setup will reduce Evans' stockpile of orders quickly and assure prompt service on future orders. O. T. Hillshafer, vice-president, will continue as general manager.

* *

New Company: Known as the Ohio Stainless Steel Company, a new concern has been established by Paul Keller and E. B. Farris at Cleveland to handle all types of stainless steel products. Both men formerly were associated with Copperweld Steel Company.

The new concern will represent several stainless steel companies in the Central West, including Jessop Steel Company, Joselyn Manufacturing and Supply Company, and Babcock and Wilcox Tube Company.

* *

Out of the Ashes: From the rubble of a disastrous fire that razed the Modern Collet and Machine Company plant, Ecorse, Mich., last Christmas Day, are rising a new plant and a reorganized company. Almost full-scale production is getting under way this month, replacing the limited operations that have been carried on in an undamaged warehouse and in several other plants. Under the reorganization setup, Browney Mascow, will head the company as general manager. Joseph Maygar will retain his position as factory manager, and former employees loaned to other concerns will return.

* *

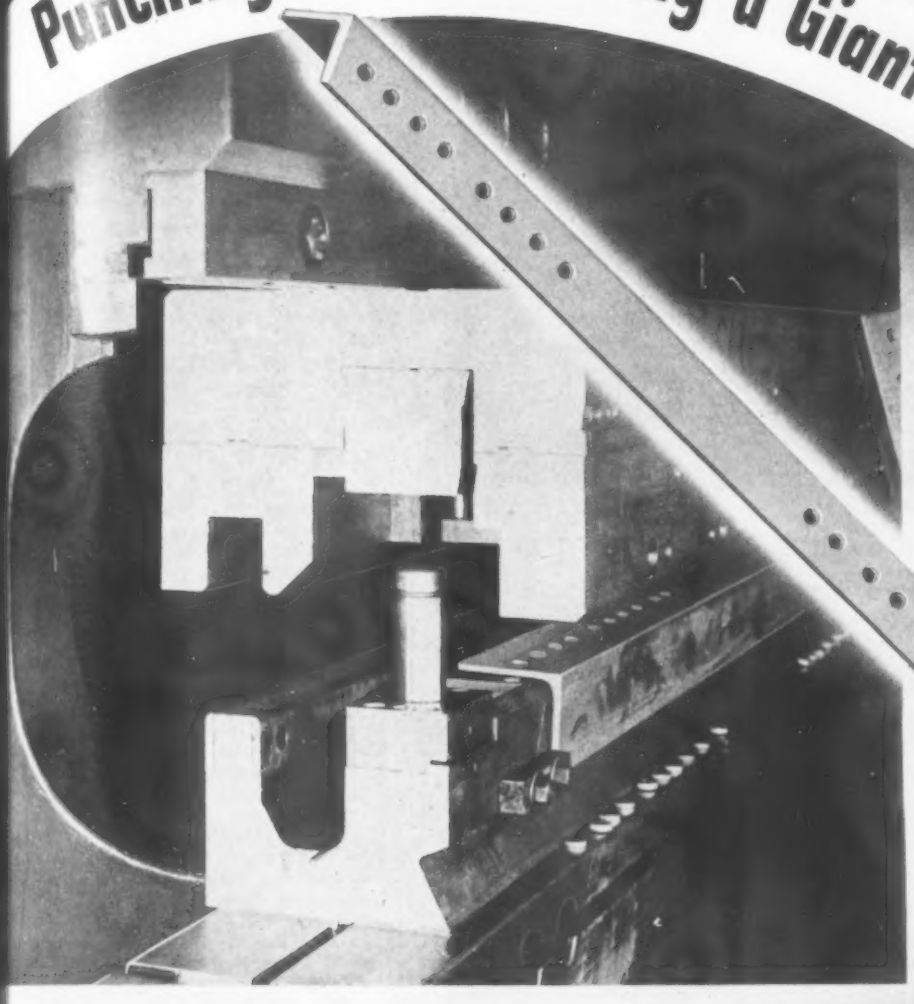
Agency: Rudel Machinery Company, Incorporated, has been named representative for the New York and Hartford territories by Logansport Machine Company, Incorporated. Also, it is announced, the C. G. Wilson Company, Logansport representative for the Dallas territory, has been assigned the Tulsa, Okla., District.

* *

Appointments: New officers appointed by the Board of Directors of Onsrud Machine Works are: Chairman of the Board, O. Onsrud; President and General Manager, R. F. Onsrud; secretary, J. Know. T. W. Foote has been retained in his position of Vice-President, and H. R. Krabel will continue as Treasurer.

(Continued on page 128)

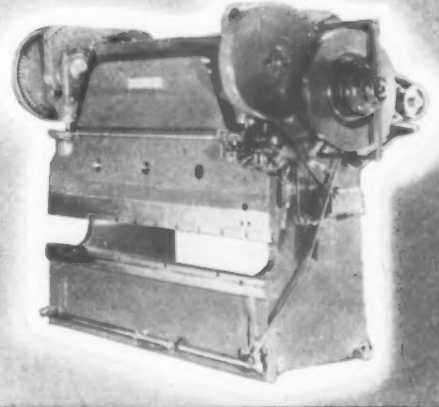
Punching and Trimming a Giant "Mechano" Set...



With this giant version of "Little Willie's" Christmas toy, U. S. engineers restore devastated port handling facilities or create new ones with magic speed.

On this punching and trimming job holes must match up and edges must be true—Accuracy is a first consideration. The machine tool-like performance of Cincinnati Press Brakes does the job smoothly and economically.

For a complete picture of the wide uses of these brakes, write for Catalog B-2.



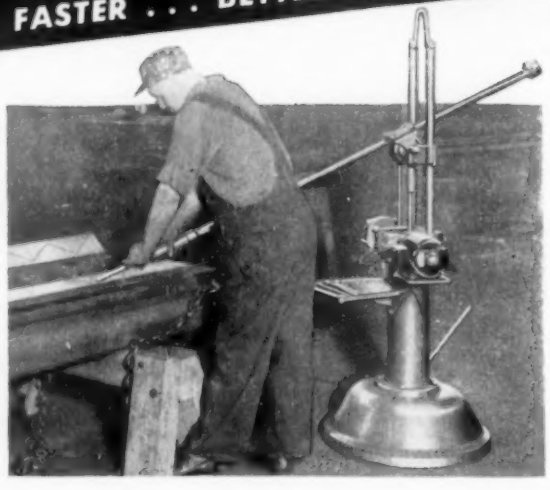
THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

POWER SCRAPING

EASIER . . . FASTER . . . BETTER WORK



SPEED UP *your* PRODUCTION *with the*

ANDERSON POWER SCRAPER

The Anderson Power Scraper has a "natural hand control" . . . is as easy to use as a hand scraper. The left hand, as with a hand scraper, serves as a guide to the blade . . . the right hand controls the stroke. Pressure of the left hand controls the depth of the cut, but the forward cut requires no backbreaking labor. A slight forward pressure on the cylinder with the right hand starts the swift, smooth forward stroke which can be regulated from nothing to 3½ feet . . . 60 feet per minute, reverse speed 90 feet per minute. The operator can work at a steady rate without tiring as the ¼ h. p. motor does the heavy cutting. With this machine one man can do the work of several.

Portable

The Anderson Power Scraper, mounted on an elevating truck can be easily moved to any location. The machine may be plugged into any handy electric lamp socket and be ready for use. In the scraper housing directly across from the motor is a scraper blade grinder . . . a convenient, speedy means of resharpening scraper blades without leaving the machine.

CARBOLOY TIPPED SCRAPER BLADES

THEY LAST 8 TO 10 TIMES LONGER

Available in three widths to fit the Anderson standard line of hand scrapers. Simply remove the high-speed steel blade and slip in the Anderson Carboloy Tipped Blade.

If you are already using Anderson Hand Scrapers it is not necessary to buy complete new scrapers in order to use carboloy tipped blades.

Speed up your scraping operation with these more efficient, longer lasting blades. They are especially good for the new hard alloy iron and the extremely hard bronze castings used in war equipment.

ANDERSON BROS. MFG. CO.
Anderson
ROCKFORD, ILL. U.S.A.

Get all the facts on power and hand scrapers Write for Bulletin 510

INDUSTRIAL NEWS DIGEST

(Concluded from page 126)

Jobs for Veterans: Typical of the planning done by many companies for employment of discharged veterans is the program initiated by Brown Instrument Company of Philadelphia.

Cooperating with draft boards within a 35-mile radius, the company issues a weekly list of jobs open, types of men needed and experience required. In cases where veterans are qualified by reason of previous education or experience, training in servicing, operation, and maintenance of the company's products is offered.

* *

Examples of jobs offered are: Process, time study, and methods engineers; expediter; sales correspondents; tool makers; inspectors (first class and apprentice); bench and machine hands; operators of hand screw machines, milling machines and drill presses; truck helper, and general helper. Veterans must be considered physically and mentally recovered to permit them to work.

* *

Changeover: Indicating a trend away from munitions production, occupation of Plant No. 1 of the original Lowell Ordnance works at Lowell, Mass., by the wire and cable department of United States Rubber Company has been announced.

JEWELS BY MASS PRODUCTION

● PITTSBURGH—Tiny sapphire jewels threatened to hold up manufacture of instruments when their source, Switzerland, was cut off at the beginning of the war.

Millions of electrical instruments awaited a substitute for the jewels until American ingenuity found a way to make them from glass. At first, they were produced by hand, one at a time. At best, a worker could make about 1,200 a day, many of which were imperfect.

Now they are turned out by automatic machines at the rate of 3,500 per day. One girl can tend two machines that produce almost no poor jewels, according to Westinghouse engineers. For many instruments jewels of glass now are preferred to those of sapphire.

Machinery and equipment will be installed as soon as the Ordnance Department clears munitions-making equipment out of approximately one-half million square feet of floor space. The plant will manufacture communications cables for the Signal Corps.

* *

Rehiring Program: A return-to-work program for former employees now in the armed forces has been announced by the International Harvester Company. The veterans will be rehired and will be given training if necessary.

The program, which aims to provide "a job for every qualified Harvester veteran and to qualify every Harvester veteran for a job," will be administered from the Chicago office and will include all the company's manufacturing and raw materials operations and sales branches in the United States.

THE END

It takes
GOOD EQUIPMENT
to check
GOOD HOBS

You can get *both* from Michigan Tool Company

One of the reasons "Michigan" hobs are so consistently accurate is that Michigan Tool Company uses its own line of specially developed hob checking equipment for higher precision and faster checking of all the elements of a hob. This equipment is now available to hob users to insure that original hob quality will be maintained in service.

The Model #471 hob sharpening checker (illustrated above) for instance, will check:

1. Flute spacing, both parallel and spiral gash
2. Gash for correctness of radial, hook or rake sharpening
3. Parallelism of straight gashed hobs
4. Whether taper exists at O.D. of hob (across cutting edge)
5. Concentricity of proof diameters as well as O.D.
6. Pressure angle of hob as well as included angle on gear cutters
7. Lead of hob in axial section (not following helical path)
8. Depth of tooth (for topping hobs)

We will be glad to furnish hob users with further data on our various hob checkers. Ask also for a copy of the booklet on "Hobbing"—Bulletin #149-A.

ORIGINATORS of GEAR-SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD • DETROIT 12, U. S. A.

BUY U.S. BONDS STAMPS

ZING! ZIP!

AND THE METAL IS CUT!

It's as easy as that when you cut with this new DeWalt High-Speed Metal Cutting Machine

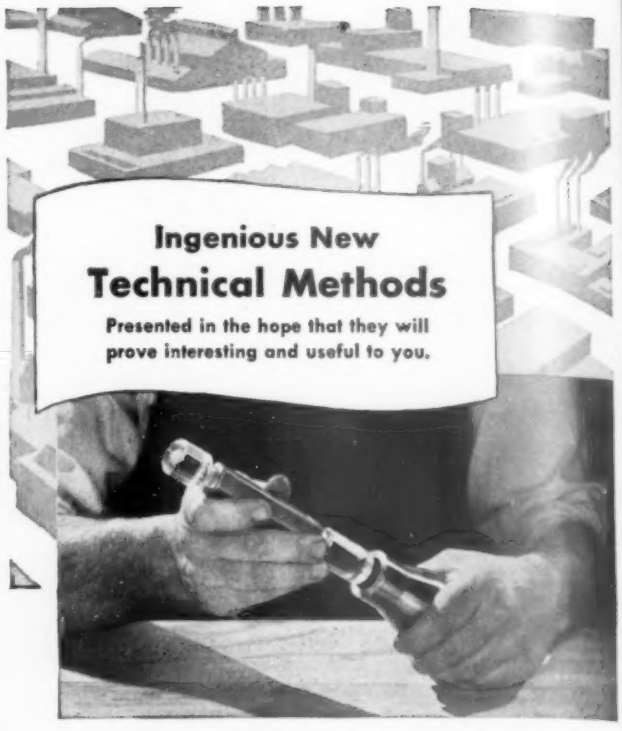
This new, high-speed DeWalt will out-perform the ordinary types of "light metal" cutting machines you have heretofore been able to buy to do comparable work. It cuts metal fast, accurately, and with greater safety. *And it's built to last.*

One manufacturer, who has a battery of these high-speed DeWalts, is cutting S. A. E. 52100 solid bearing steel into $^{15}/_{16}$" lengths—at the rate of 600 to 650 pieces per hour per machine, using women operators. The machines have already cut 4,500,000 pieces *and are still going strong.*

DeWalt engineering service helped this customer step up service. What is *your* metal cutting problem? We manufacture a complete line of metal cutting machines, and may be able to help you. Call in one of our engineers. Wire, write or phone DeWalt Products Corporation, 6101 Fountain Avenue, Lancaster, Pennsylvania.

DE WALT RADIAL POWER SAWS

LANCASTER, PENNA.



Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

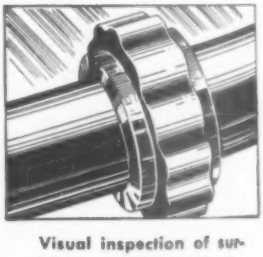
Precision Ground Glass Gages Afford Visibility in Inspection

In the hands of the skilled mechanic, glass gages bring an important plus function to precision gages. It not only checks the new tool's size, but gives the inspector an idea of what kind of surface to expect from that particular tool. The visibility permitted by the glass gage allows the inspector to see the surface in blind holes as well as through holes.

Glass gages are not subject to corrosion or rust.

Some of the apparent advantages of the glass gage follow: Glass gages afford visibility in inspection. Glass gages are not subject to corrosion. There is less tendency to gall in some applications. Sense of feel is more pronounced when using glass gages. Because the thermal conductivity of glass is less than steel, body heat of inspectors will not be transmitted so rapidly to the gage to affect gaging dimensions.

Chewing gum, too, is really useful and helpful in these tense times to people who are working on the production front making material for our war effort. But, our Armed Forces have been constantly increasing their demands for Wrigley's Spearmint, Doublemint and Juicy Fruit. It is only natural that we and you both feel that the needs of our fighting men and women come first.

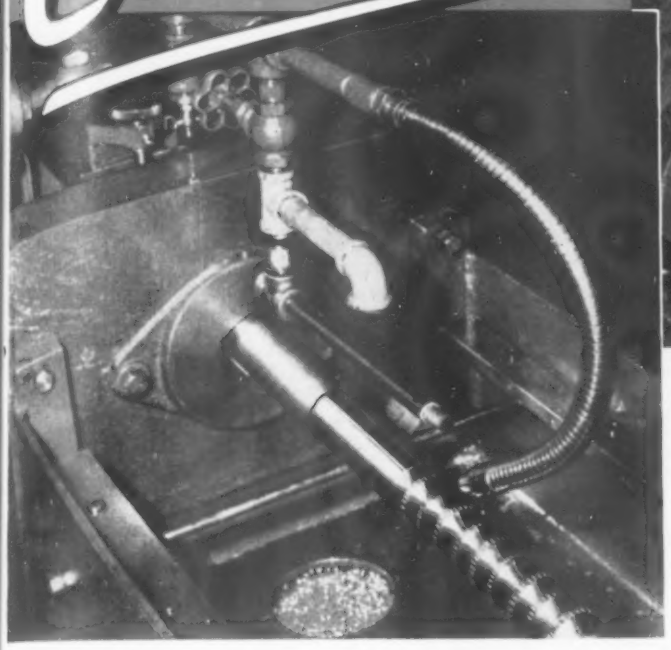


Visual inspection of surface coincident with inspection for size.

You can get complete information from Industrial Glassware Division of the T. C. Wheaton Co., Millville, N. J.

Y-114

Change to Broaching



From Boring SAVES 48½ MINUTES PER PIECE

A large manufacturer formerly produced hydraulic cylinders for aircraft by boring, grinding and honing. The boring and grinding operations alone required 50 minutes. Now these parts are broached and honed. This method requires 1½ minutes per piece exclusive of the honing. The broaching produces a surface comparable to the ground surface so that both pieces require about the same amount of honing. Thus 48½ minutes are saved on every piece and several turret lathes and grinders, together with their operators, are released for other work.

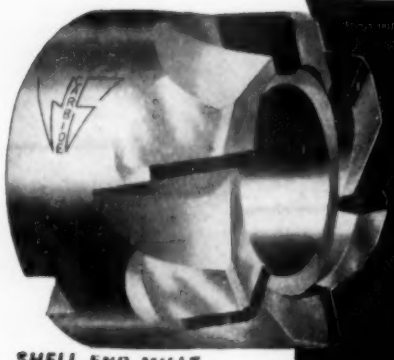
This is a typical example of the savings in time and cost and the product improvement made possible where Detroit Broach tools and accessories are used. Go over your production plans with a Detroit Broach Company engineer. He may be able to suggest several ways in which broaching can help you gain greater production at lower cost. He will be glad to submit complete cost and production data without obligation to you. Write Detroit Broach Company today.

ARMY NAVY

DETROIT BROACH COMPANY

20201 SHERWOOD AVENUE • DETROIT, MICHIGAN

9308 SANTA MONICA BLVD. • BEVERLY HILLS, CALIFORNIA



SHELL END MILLS

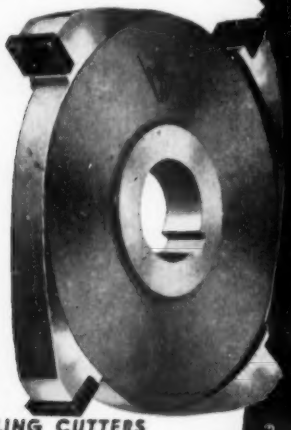
Tool No. SEM for cast iron and non-ferrous materials. Tool No. SSM for cutting steel. Sizes 1¼" to 6". 4 to 10 teeth. Use up to 20" table feed per minute.

Again

WENDT SONIS

STANDARDIZES

another group of carbide tipped tools



MILLING CUTTERS

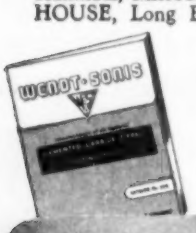
Five tool styles for milling steel and non-ferrous materials. Diameters; 3" to 8". 4 to 10 teeth.

They're here! They're New! They're Standard! These Wendt-Sonis cutting tools are especially designed carbide tipped cutting tools—not adaptations of high speed steel designs.

DISTINCTIVE CHARACTERISTICS—

1. **New flute angles**
2. **New fillet designs**
3. **New shank designs**

—**plus** 25% longer carbide tips on all round tools. All these new tools—many of which were formerly classed as "special" are now standard and listed in new W-S Catalog No. 144. Order through your nearest Wendt-Sonis distributor . . . or write to WENDT-SONIS COMPANY, Hannibal, Missouri or BRANCH WAREHOUSE, Long Beach, Calif.



NEW!

W-S Catalog No. 144 just off the press. Contains all new standardized tools and latest prices. WRITE TODAY for your FREE copy.

WENDT SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • ROUTER BITS • SPECIAL TOOLS

(Continued from page 113)

the markdown to eliminate speculation.

At this writing, there is wide difference of opinion among the builders regarding the percentage of discount which should be applied to individual machines under the second program. Figures suggested range from 25 per cent to 75 per cent. A figure of approximately 50 per cent probably will be proposed, it is believed.

Plans involving the disposal of excess machine tools through the nation's vocational schools is not considered seriously by the men who built the machines. The highest figure yet suggested that could be absorbed through these channels is only $200,000,000 worth.

The nation, through its war effort, has an investment of $2,700,000,000 in machine tools. Despite the fact that the machine tools represented by this figure could well deplete their post-war market, the large, substantial builders insist the country cannot afford to cross this investment off as profit and loss.

They would like to see the bulk of the machines go directly into peacetime production in the smaller metal working industries of this country, to permit lower production costs that would meet foreign competition and provide industry sufficient prosperity to purchase still more efficient post-war designed machines.

"All the machine tool builder wants is a prosperous metal working industry in the United States after the war," one industry leader told The Tool Engineer. "With that, we will take our chances."

REPORT AVAILABILITY

● **OPA** gathers reports for redistribution program

WASHINGTON—Obviously a part of the government's effort to compose a reliable, over-all picture of the machine tool situation in the United States, the War Production Board has delegated authority to the Office of Price Administration to require dealers, agents, auctioneers, brokers and machinery manufacturers who sell second-hand machines and parts file reports on available machinery on hand.

The purpose of this move, the WPB has announced, is to consolidate in one agency the right to obtain, on a mandatory basis, specific information regarding the availability of second-hand machinery and equipment. "The consolidation of this information," WPB said, "is necessary for the conduct of WPB redistribution programs."

PRODUCTION TRENDS

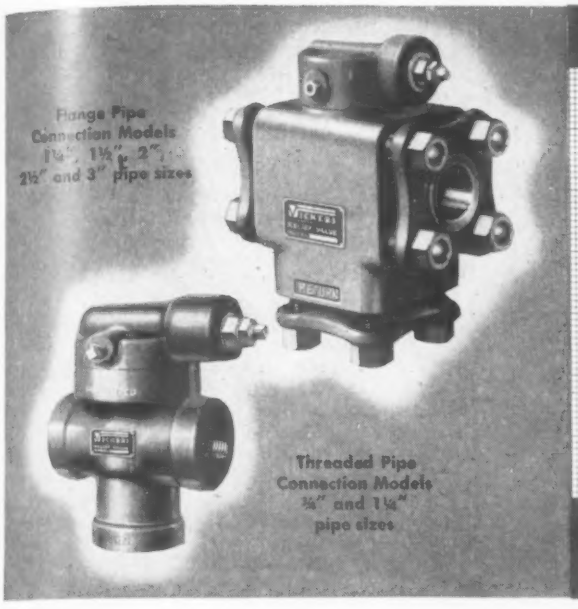
● **Decline continues; Russian orders make news**

Though output and shipments continued to decline during February, the machine tool industry enjoyed substantial if short encouragement in witnessing a rise in firm orders and a sharp drop in cancellations.

(Concluded on page 134)

MORE ACCURATE

HYDRAULIC PRESSURE CONTROL



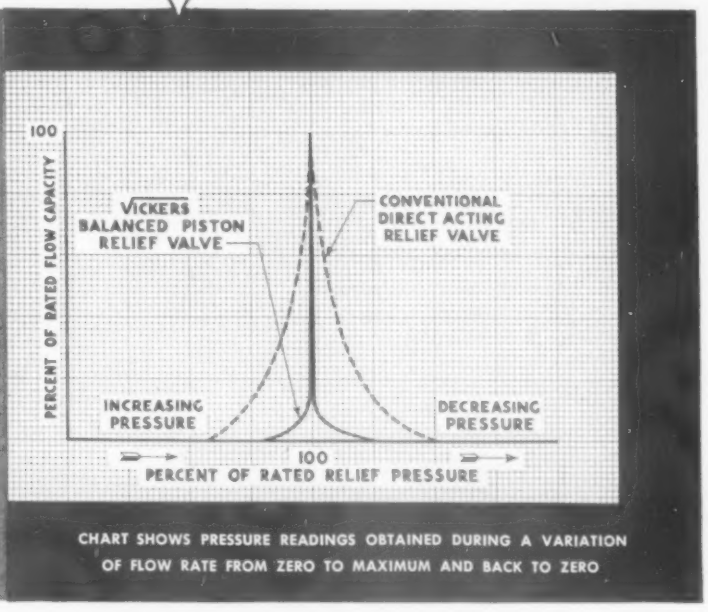


CHART SHOWS PRESSURE READINGS OBTAINED DURING A VARIATION OF FLOW RATE FROM ZERO TO MAXIMUM AND BACK TO ZERO

VICKERS

Balanced Piston Type

RELIEF VALVES

As indicated by the chart above, Vickers Balanced Piston Type Relief Valves have a negligible pressure variation throughout their capacity range. In these valves a hydraulically loaded and balanced piston takes the place of the customary spring-loaded direct-acting relief mechanism. This means more sensitive operation as well as greater accuracy throughout the wide pressure range.

This accuracy of control prevents pressure override when sudden changes in pressure occur in the hydraulic system. Compact design, longer operating life, installation directly in the pressure line, quiet operation, and simple adjustment are other advantages of these Vickers Balanced Piston Relief Valves. See Bulletin 38-3 for complete information.

Vickers Application Engineers will gladly discuss with you how Vickers Hydromotive Controls can be used to your advantage.

VICKERS *Incorporated*

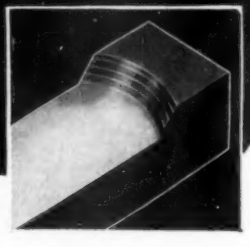
1416 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES
NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

Introducing the KENNAMILL

The amazingly simplified inserted-blade step-cutter that makes high-speed carbide face-milling of steel possible in every shop!



Partially completed cut illustrating method of flycutting in steps—note bright, smooth finish obtained.

A sensational Kennametal achievement—the KENNAMILL—can give new life to your milling machines . . . adapting them for the high speed milling of steel that is inherent in modern, negative rake carbide cutters. At the same time, the Kennamill can improve the quality of your work by producing finished surfaces that are exceptionally smooth and accurate.

Kennamills are inserted-blade cutters, available in four sizes with taper shanks to fit standard spindles, as listed below. All sizes use the same ⅝" square, 10° negative back rake Kennametal-tipped blade (Cat. No. 39M40). Two sets of blades are supplied with each cutter head.

The low initial cost of Kennamills is combined with economy of blade maintenance. No expensive grinding equipment is needed—the blades are easily removed from the cutter head and resharpened to a template on a simple adjustable table carbide grinder. Accurate resetting in the head is not necessary since each blade cuts an independent path.

The use of Kennamills assures optimum machine performance. The sturdiness of the cutter body, plus distribution of the work over the keen-cutting Kennametal-tipped blades, minimizes vibration and chatter, smoothes out the load, and fully utilizes available horsepower, with feeds up to 21" per minute.

Kennamills are available for immediate delivery. They are stocked at our factory, and at Kennametal offices in Atlanta, Chicago, Detroit, Houston, Los Angeles, Philadelphia, New York, and San Francisco. Get in tune with the fast-moving tempo of carbide steel milling—order Kennamills today.

PRICES OF KENNAMILLS
(Complete, with 2 sets of No. 39M40 Kennametal-tipped blades)

Size	Fits Spindle	No. of Blades in Cutter	Price Each
2"-40	#40	3	$31.91
2"-50	#50	3	35.41
3"-40	#40	4	39.89
3"-50	#50	4	41.22
4"-50	#50	4	43.04
5"-50	#50	4	44.85

Extra Blades (No. 39M40) each $1.83
Templates—for regrinding blades—each $1.75

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., 600 LLOYD AVE., LATROBE, PA.

—MACHINE TOOLS—

(Concluded from page 132)

February, the last month for which statisticians of the WPB's Tools Division have completed a business index, provided substantially the same story that has been repeated here month after month since December, 1942, when output of the industry reached the sky-high figure of $131,900,000.

Actual value of machine tools shipped during February, WPB has announced, totaled $50,150,000, a decrease of another 11 per cent from the $56,349,000 in shipments during the preceding month.

Total orders received by builders during February amounted to $33,512,000, an increase of more than 12.5 per cent from the January total of $29,736,000. Equally satisfying to the industry was the sharp drop in cancellations, which declined more than 37 per cent during the month to approximately $2,057,000. In contrast, January cancellations stood at $3,280,000.

Nonetheless, the industry's order bank continued to slip precipitously, and the day of almost complete conversion to direct war work appeared nearer. Unfilled orders remaining on the books at the end of the month declined 10.4 per cent according to Washington bookkeepers. The backlog on the last day of the month stood at $162,667,000, as compared with the backlog of $181,548,000 at the end of January.

The government figures are based on reports from 281 companies in the industry, plus estimates for 66 concerns whose reports for the month had not been received in the Capital at the time of the compilation. As always, the report covers only non-portable, power-operated tools, with a valuation of $350 or more each, used to shape metal products by progressively removing metal by such methods as drilling, grinding, boring, milling and planing.

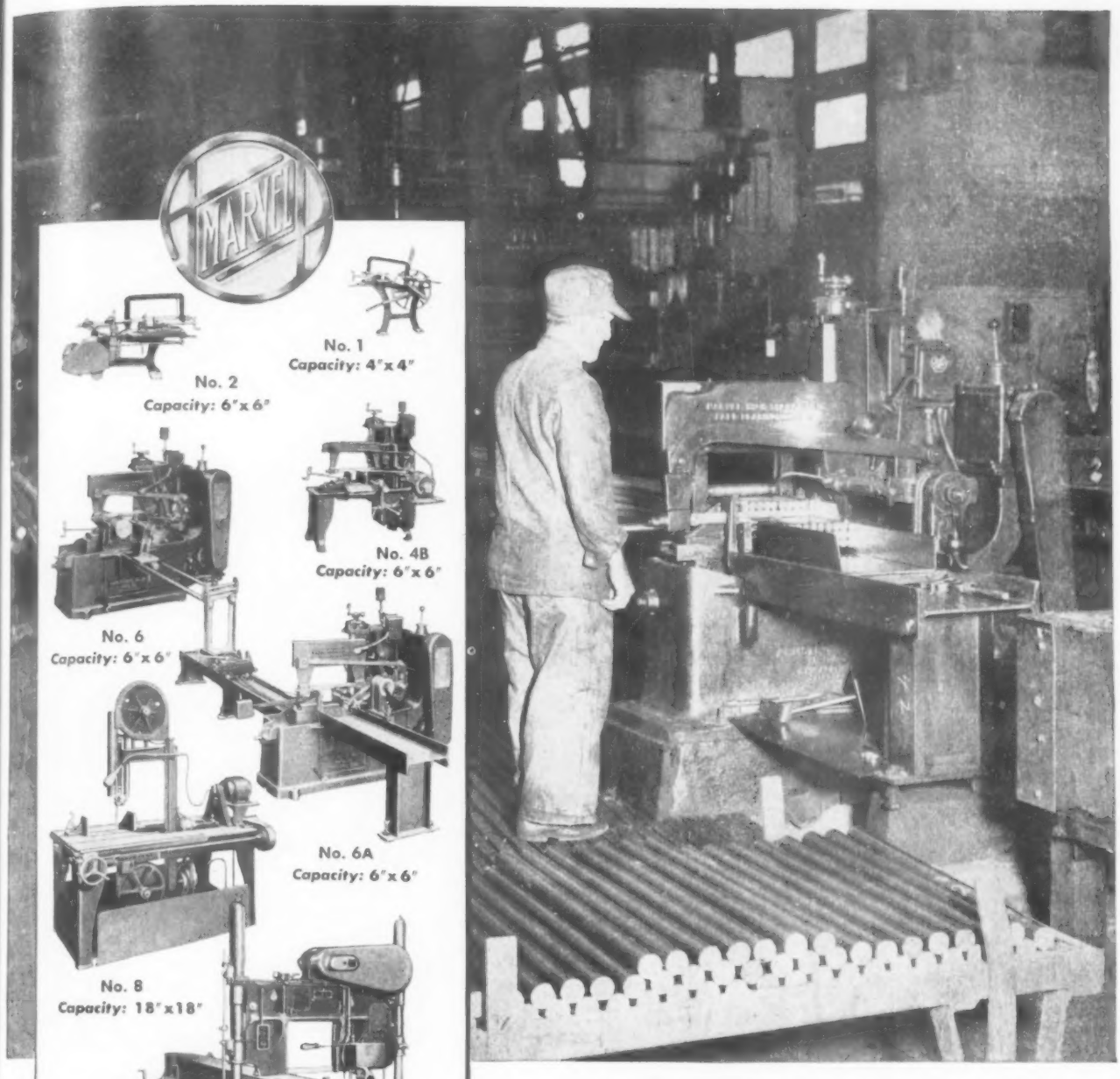
Metal forming machines, such as presses, forging hammers, extruding machines and shears are not included in these figures.

Proof that the task of tooling American industry for war has been completed lies not alone in the fact that new orders, except for a short upward spurt in February, have continued to decline month after month.

Analysis of orders on hand, it has been learned, reveals that a substantial portion of the machines now being built are scheduled for shipment to Russia. Figures as high as 25 per cent are being used in describing this portion of current business. What a quick termination of Russian war production might do to these orders largely is a matter of conjecture. It is felt in Washington, however, that most of the machines on order are scheduled for the rehabilitation of Soviet industry in preparation for peacetime production.

The temporary rise in February orders can be traced directly to automobile industry tooling for new, larger aircraft engine jobs being undertaken by Buick, Chevrolet and the Dodge-Chicago plants. Tooling of these projects, The TOOL ENGINEER has reported previously, is scheduled for completion before the end of the year.

THE END



This MARVEL 9A Production Saw paid its cost in 30 days

There's none of the old fashioned, tedious, plugging-along type of hack sawing at the Shop of the I. C. Railway, because they do their cutting-off with a high speed MARVEL No. 9A Production Saw—the same MARVEL Saw used to cut-off astronomical numbers of rifle and machine gun barrels.

Built for continuous heavy-duty operation, this really fast, all-ball-bearing saw automatically feeds, measures and cuts-off single or nested bars with no more operator attention than an automatic screw machine. On the job illustrated above, six hours after forty 18′ x 1″ steel bars were laid on the saw's feed rack, they had been cut into 840 accurate, 10-inch lengths, for staybolts. Equally efficient on both production runs and miscellaneous cuts, this saw "paid for itself in the first thirty days of operation".

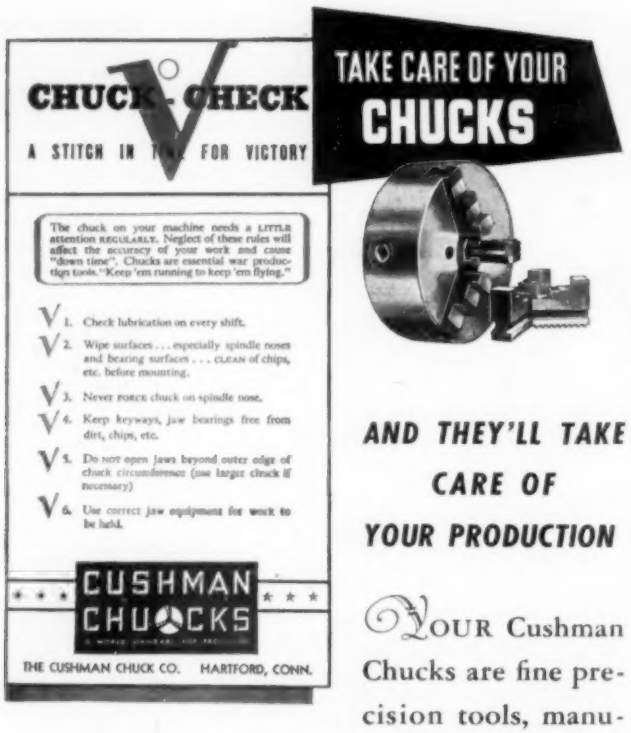
Write for New Catalog

BUY FROM YOUR LOCAL DISTRIBUTOR

ARMSTRONG-BLUM MFG. CO.

5700 Bloomingdale Ave. Chicago 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.


CHUCK-V-CHECK
A STITCH IN TIME FOR VICTORY
The chuck on your machine needs a LITTLE attention REGULARLY. Neglect of these rules will affect the accuracy of your work and cause "down time". Chucks are essential war production tools. "Keep 'em running to keep 'em flying."
V 1. Check lubrication on every shift.
V 2. Wipe surfaces . . . especially spindle noses and bearing surfaces . . . CLEAN of chips, etc. before mounting.
V 3. Never force chuck on spindle nose.
V 4. Keep keyways, jaw bearings free from dirt, chips, etc.
V 5. Do not open jaws beyond outer edge of chuck circumference (use larger chuck if necessary)
V 6. Use correct jaw equipment for work to be held.
CUSHMAN CHUCKS
THE CUSHMAN CHUCK CO. HARTFORD, CONN.

TAKE CARE OF YOUR CHUCKS

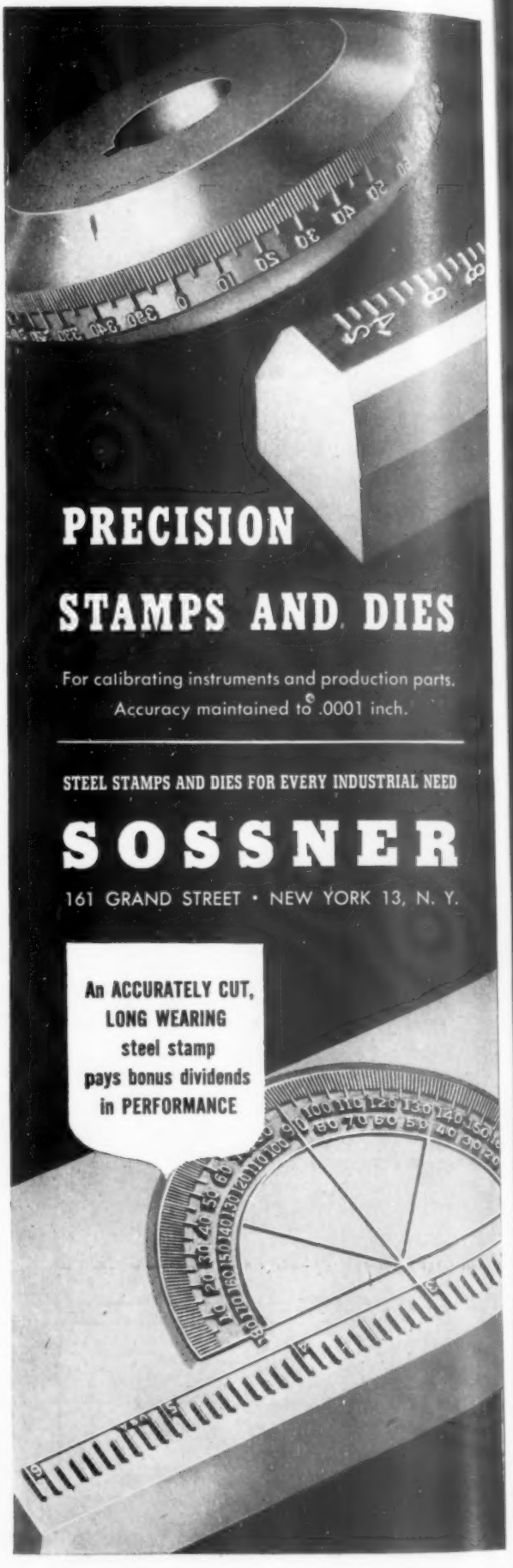
AND THEY'LL TAKE CARE OF YOUR PRODUCTION

YOUR Cushman Chucks are fine precision tools, manufactured to meet your most exacting production requirements over a long service life. But today, just as war production has to go far beyond the most optimistic estimates, so must we stretch the effective life of all tools, including chucks.

That is why care is so vitally important. That is why we have made up and offer for your use the "Chuck Check" card. The simple practices suggested are obvious common sense, but with so much to be done in a day, even these points may be overlooked in your plant if they are not emphasized. Because this extra care will make your chucks last longer and do better work for you we suggest that the card be posted near every machine that uses a Cushman Chuck. We will be glad to supply a quantity for use in your plant.

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS


PRECISION
STAMPS AND DIES
For calibrating instruments and production parts.
Accuracy maintained to .0001 inch.
STEEL STAMPS AND DIES FOR EVERY INDUSTRIAL NEED
SOSSNER
161 GRAND STREET • NEW YORK 13, N. Y.
An ACCURATELY CUT, LONG WEARING steel stamp pays bonus dividends in PERFORMANCE

"Blue" Is the Signal for "Go"

The *blue flash* trademark now being applied to Bay State Portable Snagging Wheels means go ahead, full speed.

Bay State Portable Snagging Wheels cut fast and cool, and the exclusive (patent pending) method of imbedding the nut is an important safety feature. Furthermore, the 3/16" diameter wire ring moulded into the wheel and the finer abrasive around the nut aid in supporting the nut, and give added strength to the thinnest part of the wheel.

These special features of Bay State Portable Snagging Wheels will give you an idea of *extras* from Bay State . . . the finest honing and superfinishing stones ever manufactured . . . grinding wheels in fractional grades . . . mounted points and wheels that are ground, not pressed, to shape.

Bay State engineers will help you determine the best type, size and grade for almost any grinding or finishing job you may have.

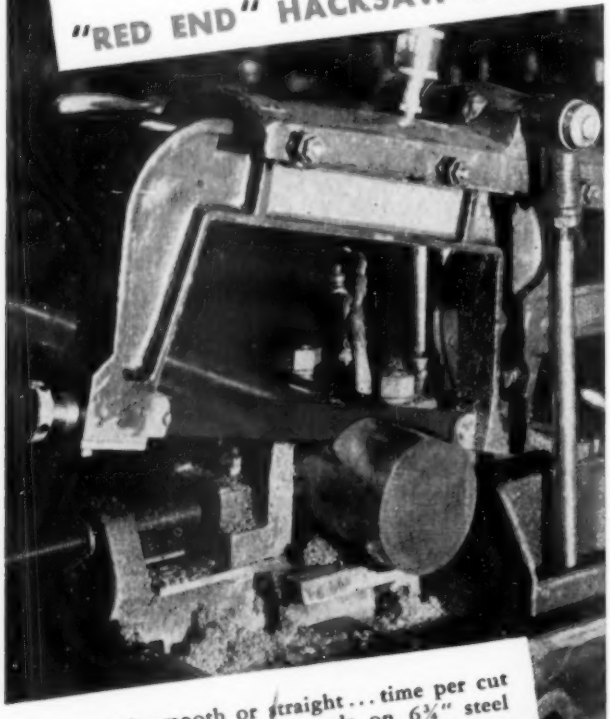
Write for Bulletin C on Portable Snagging Wheels.

BAY STATE ABRASIVE PRODUCTS CO.
WESTBORO, MASS.

BLUE FLASH GRINDING WHEELS *FAST and COOL*

HONING AND SUPERFINISHING STONES · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS
PORTABLE SNAGGING WHEELS · MOUNTED WHEELS · AND POINTS · GRINDING WHEELS

They Saved 15 Minutes Per Cut with Precision-Tensioned SIMONDS "RED END" HACKSAW BLADES



Cuts weren't smooth or straight . . . time per cut was 27 minutes and 15 seconds on 6¾" steel rounds . . . when the Simonds Cutting Engineer was called into this war plant to examine the job. After the correct blade-tension was determined by Simonds' new method, it was possible to double the feed. *Result:* Time per cut shortened 50% . . . and each cut straight and smooth, without ladder-marks.

Such results, of course, are not possible in every case. But in a majority of cases, *some* worthwhile improvement or saving results when a Simonds engineer gets a look at the cutting operation . . . no matter whether it's on metal, wood, or other materials. And there's no obligation. Just tell your Industrial Supply Distributor or Dealer to bring the Simonds man to *your* plant.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 228 First Ave., San Francisco 5, Calif.; 311 S.W. First Ave., Portland 4, Ore.; 520 First Ave. So., Seattle 4, Wash.; 31 W. Trent Ave., Spokane 8, Wash.

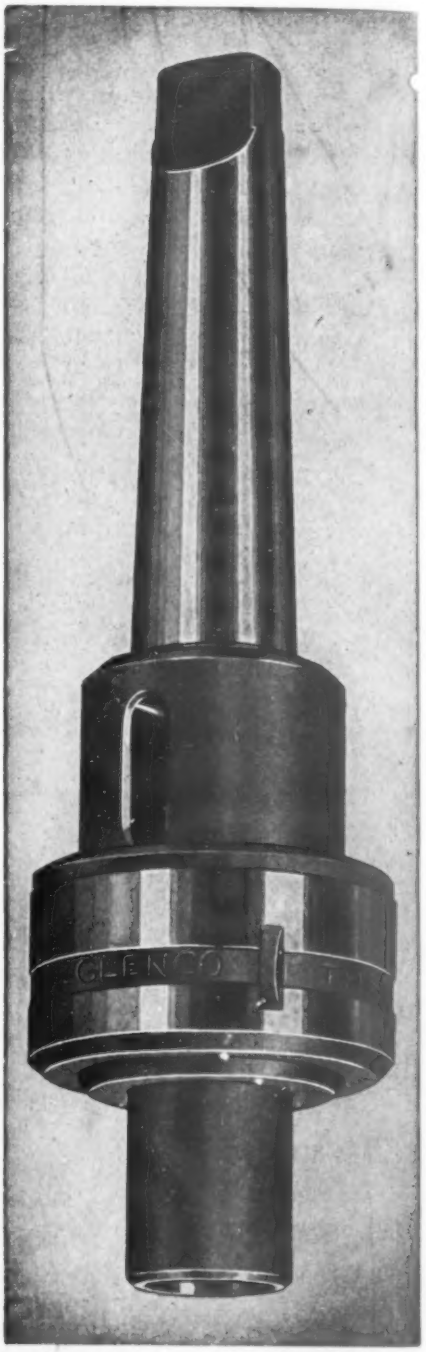
PRODUCTION TOOLS FOR CUTTING METAL, WOOD, PAPER, PLASTICS

SHORTEN THE WAR . . . BUY BONDS

SIMONDS SAW AND STEEL COMPANY
FITCHBURG, MASSACHUSETTS

GLENCO
FLOATING TOOLHOLDER

Corrects Machine Tool Misalignment By Producing TRUE and ACCURATE Holes



Also Manufacturers of *Utility Tools*

FLOATING HOLDERS
SPOTFACERS
COUNTERSINKS
REAMERS
COUNTERBORERS
LIVE CENTERS
SLEEVES
TAP CHUCKS
DRILL CHUCKS
ADJUSTABLE ADAPTERS
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SPACING COLLARS
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END MILLS
WOODRUFF CUTTERS
CORE DRILLS

THE J. C. GLENZER CO.
DETROIT MICHIGAN

The Marines Took Tarawa . . .

the Army Took Africa and Sicily . . .

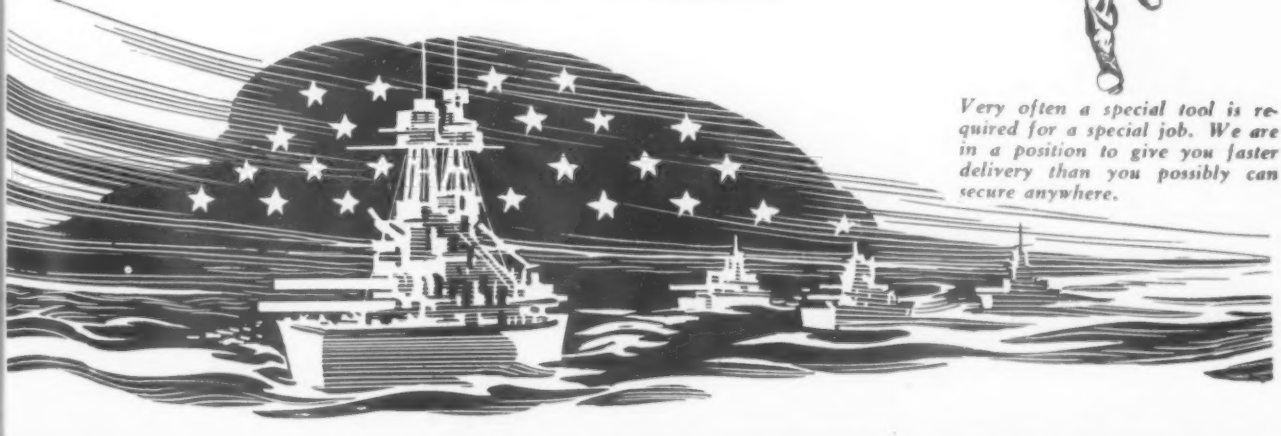
the Navy's Taking the Pacific

NOW IS THE TIME FOR YOU TO TAKE INVENTORY OF YOUR SCRAP PILE!

Used tools should not be scrapped until you have first consulted with our Tool Engineering Service Department. Here lies your greatest source of new tool supply and lower tool costs.

High-speed steel, properly heat treated, is hard and tough to the core. It will retain its temper, even after its cutting edges are entirely worn away. Your cutters are held to the largest possible diameters and widths or reduced to the next standard size, or according to your plans.

Very often a special tool is required for a special job. We are in a position to give you faster delivery than you possibly can secure anywhere.



A COMPLETE RECONDITIONING SERVICE FOR TOOLS

NEW MILLING CUTTERS FROM OUR STOCK OR YOUR OWN STANDARD CUTTERS CAN BE QUICKLY CONVERTED TO SPECIAL CUTTERS

EASTERN CUTTER CORPORATION 30-32 Littleton Ave., Newark 7, N. J.

Chrome Plant **MASTER CHROME SERVICE** INC., 5709 Herman Ave., N. W., Cleveland, Ohio

FOR GREATER STRENGTH AND LONGER LIFE

•

The "Mercury" Twist Drill is the answer to Industry's demand for small diameter twist drills with heavier cross sections.

★ *Mercury Twist Drills are proportioned to add great strength and effectiveness to a design that lends itself readily to fast cutting under heavy feeds.*

★ Mercury Twist Drills have flutes of a faster spiral — well rounded, highly finished chip chutes, extra heavy webs and margins of extreme hardness and smoothness.

★ Mercury Twist Drills are subjected to a special heat treatment which produces a black-all-over, extremely dense surface hardness.

★ *Because of the extra heavy construction, it is necessary to thin out the webs slightly, directly back of the point when sharpening Mercury Twist Drills.*

Mercury Twist Drills are available in the following sizes:

WIRE GAUGE — No. 1 to 60 inc.

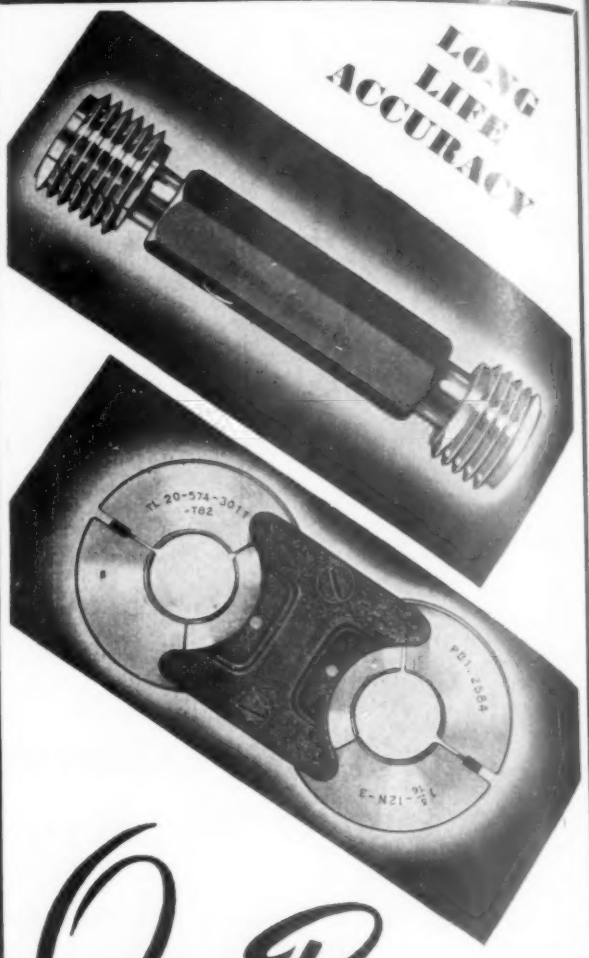
LETTER SIZES — "A" to "Z"

FRACTIONAL SIZES — To and including 39/64" with straight and taper shanks.

COGSDILL TWIST DRILL COMPANY

BOX 97, COLLEGE PARK STA.

DETROIT 21, MICHIGAN



Our Purpose

TO HELP YOU PRODUCE A FINER PRODUCT . . .

This can be done only by controlling the size of threaded holes and studs with quality gages.

No matter what thread form the product calls for, we are ready to furnish you with finest quality gages in sizes from 0-80 up to and including 6⅝" O.D.

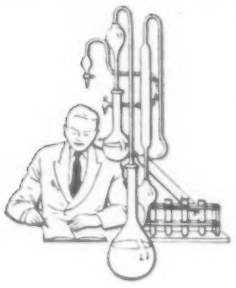
Our gages, made from the finest tool steels, are scientifically ground and carefully lapped, thus assuring you gages which last longer.

Specify Gages by Republic Gage

REPUBLIC GAGE

2228 FENKELL AVE.
DETROIT 21, MICH.

PHONE
UNiversity 1-0370



"Sterling" Stainless Steels

FOR DISCRIMINATING USERS

A complete line of wire, rod and bars

FIRTH-STERLING—a mill with a national reputation for consistently high quality Tool and Alloy Steels—is in a unique position to meet the special requirements of discriminating users of Stainless Steels. Since 1913, when FIRTH-STERLING made the first Stainless Steel produced in this country, we have specialized on made-to-order types for the most exacting specifications. Literature is available, giving complete details.

"Sterling" Stainless Steels Meet Special Requirements such as:

1. Closely Controlled Compositions.
2. Exacting Physical Requirements.
3. Surface Perfection in Various Finishes.
4. Precise Size and Shape Tolerances.

Ask For:

Bulletin No. SL-2009 on Types 420, 440-A, 440-B, and 440-C.

Bulletin No. SL-2010 on Types 403, 410, and 416.

Bulletin No. SL-2011 on Types 302, 303, and 304.

Bulletin No. SL-2018 on Cold Finished Stainless Steels.

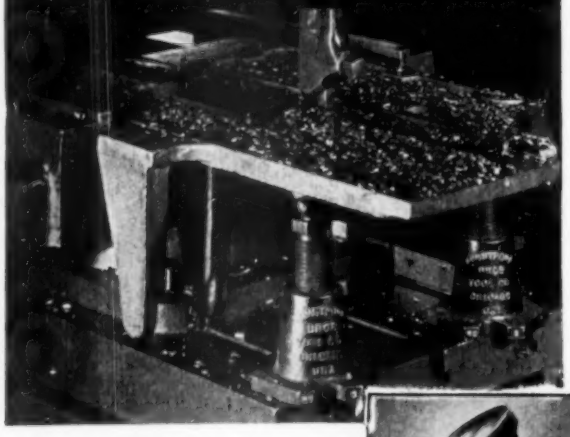
Makers of Fine Stainless Steels Since 1913

Firth-Sterling

STEEL COMPANY

Offices: McKeesport, Pa. New York - Hartford - Philadelphia - Cleveland - Dayton - Detroit - Chicago - Los Angeles

ARMSTRONG
DROP FORGED SETTING-UP TOOLS



DROP FORGED SETTING-UP TOOLS

This is no time to have men pawing over the scrap pile for makeshift setting-up materials. At any time it's bad shop practice when permanent efficient time saving ARMSTRONG SETTING-UP TOOLS can be picked up from the nearest Mill Supply house. ARMSTRONG Planer, Jacks, Bracing Jacks, Strap Clamps and T-Slot Bolts cut setting-up time to a fraction on Planers, Shapers, Boring Mills, Milling Machines and other machine tools. They assure rigid set-ups, more accurate work and prevent accidents and spoilage. They usually pay for themselves in a single job and give years and years of service. A complete line.

Write for Catalog C-39a

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
360 N. FRANCISCO AVE. CHICAGO, U.S.A.
Eastern Warehouse & Sales: 199 Lafayette St., New York

FOR UNFAILING ACCURACY

TAMALOY GAGES

Made of enduring tungsten carbide, *Tamaloy*, these gages, held to XX tolerance, can be relied upon to give long, accurate service.

Supplied, ready for use, in both plug —as shown here—and ring types.

For manufacturers preferring to machine their own gages the Tamaloy carbide ends may be secured in the rough.

For full information, standard sizes, prices, etc., write us direct.

TUNGSTEN ALLOY MFG. CO.
65 COLDEN STREET, NEWARK 4, N. J.

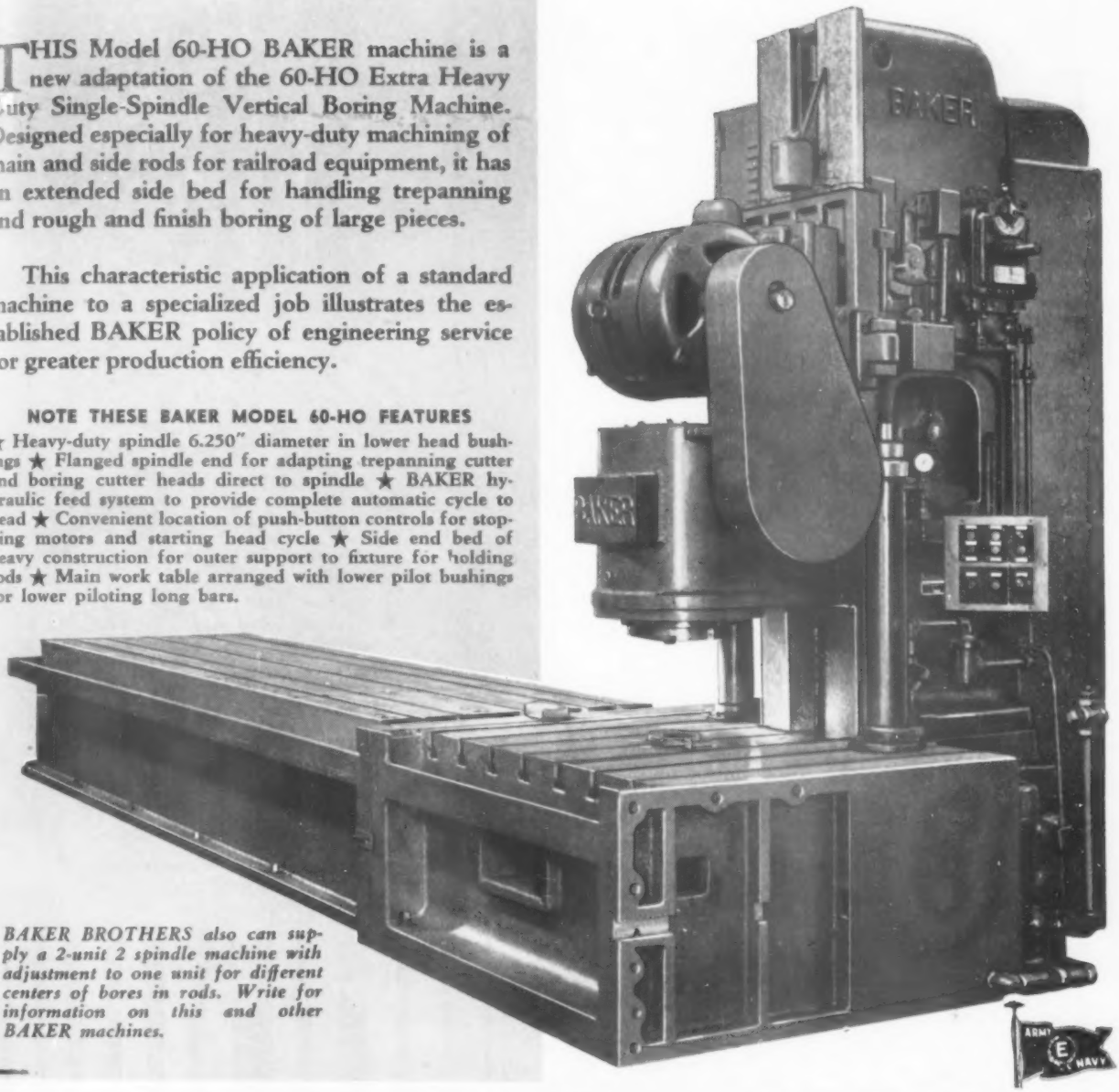
BAKER

THIS Model 60-HO BAKER machine is a new adaptation of the 60-HO Extra Heavy Duty Single-Spindle Vertical Boring Machine. Designed especially for heavy-duty machining of main and side rods for railroad equipment, it has an extended side bed for handling trepanning and rough and finish boring of large pieces.

This characteristic application of a standard machine to a specialized job illustrates the established BAKER policy of engineering service for greater production efficiency.

NOTE THESE BAKER MODEL 60-HO FEATURES

★ Heavy-duty spindle 6.250" diameter in lower head bushings ★ Flanged spindle end for adapting trepanning cutter and boring cutter heads direct to spindle ★ BAKER hydraulic feed system to provide complete automatic cycle to head ★ Convenient location of push-button controls for stopping motors and starting head cycle ★ Side end bed of heavy construction for outer support to fixture for holding rods ★ Main work table arranged with lower pilot bushings for lower piloting long bars.



BAKER BROTHERS also can supply a 2-unit 2 spindle machine with adjustment to one unit for different centers of bores in rods. Write for information on this and other BAKER machines.

ARMY E NAVY

OUR MOTTO SINCE 1867:

"MACHINES STURDY AND EFFICIENT, AS FINE AS CAN BE BUILT"

Baker Brothers, Inc.

Toledo, 10, Ohio

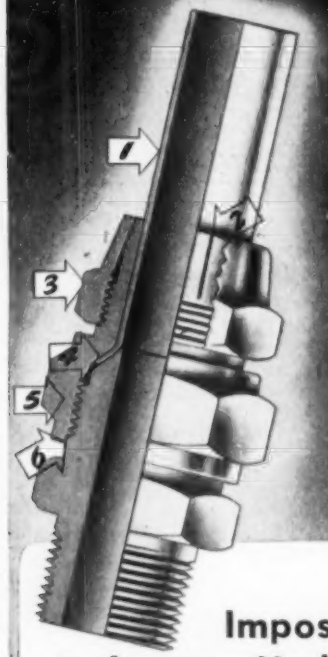
Machines for
DRILLING
•
BORING
•
TAPPING
•
CONTOUR GRINDING

COLLET GRIP

Seals as it grips

TUBE FITTINGS

NEED NO THREADING WELDING OR SOLDERING



1 Permit use of tubing in wide range of wall thicknesses.

2 SLOTTED collet insures uniform grip of tubing surface, protecting flare seal.

3 COMPRESSION NUT compresses Collet Nut to tube, forming permanent collet grip that cannot loosen.

4 DESIGN directs pulling stresses and vibration strains away from angle of flare.

5 COLLET NUT has long bearing surface which grips tube securely beyond the flare.

6 Easy to assemble and disassemble. Use repeatedly.

Impossible for Nut to Loosen Under Vibration!

Here is the quick, modern way to make tube connections that cannot work loose. "Collet Grip" fittings hold the tube securely over a long bearing surface, preventing vibration and shock from reaching the flare. Easily assembled or disassembled by tightening or loosening compression nut. "Collet Grip" design permits quick, easy installation of short lengths of tubing in close quarters. Used as standard equipment by leading machine tool and engine builders.

COTNER-WILKINSON COMPANY
Division of Logansport Machine Company, Inc.
902 PAYSON ROAD • LOGANSPORT, IND.

Fittings shown here are Double Nut design; also made in Single Nut design, simplified for close work. Each design in 5 standard shapes.

COLLET GRIP

SEND TODAY FOR CATALOG No. 43

Contains complete data on all standard fittings for tube sizes ranging from ¼" to 2"

an element of Victory

OH 38

Easily machinable

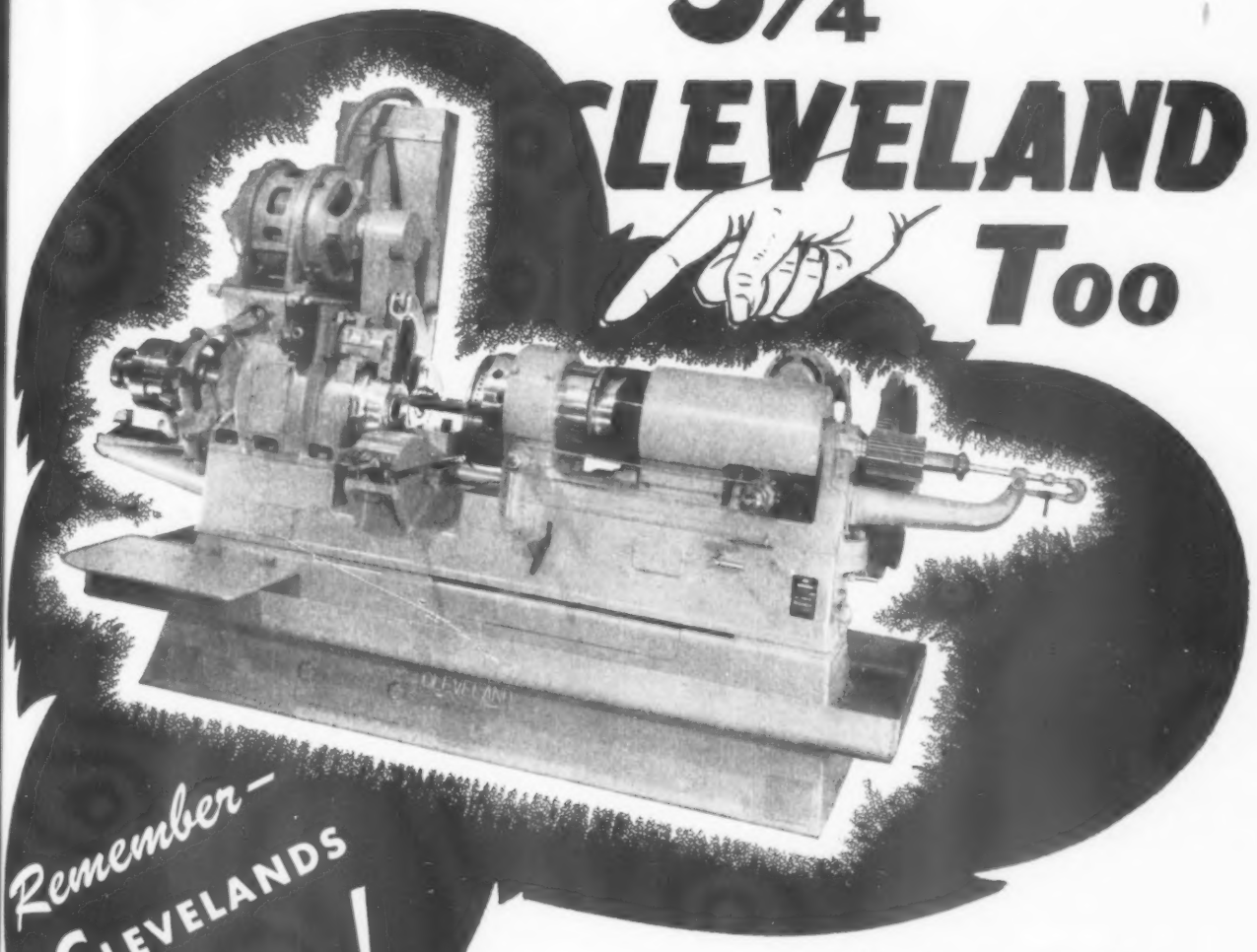
An Aluminum Alloy—Non-Heat Treated. The perfected metal that surpasses all others for a wide variety of machining operations. Non-corrosive—Easy on machine tools—Holds threads without stripping. Its light weight reduces table and machine loads and increases tooling accuracy. 5 years of proven superiority in hundreds of plants. OH 38 is an exclusive Hedstrom product.

Write for Literature

HEDSTROM

OSCAR W. HEDSTROM CORP.
4826 West Division St., Phone Columbus 3667, Chicago, Ill.
Manufacturers of Aluminum, Brass, Bronze and High Conductivity Copper Castings. Pattern Makers. Complete Mechanical Assemblies and Models to Specifications

There's A 3¾" CLEVELAND Too



Remember— CLEVELANDS CUT COSTS!

• Just one of the versatile Cleveland family. The only complete line of full automatic machines with bar stock capacities from 9/16" to 10"...

PLUS Cleveland-made high pressure hydraulic die-casting machines for magnesium, aluminum, bronze, brass or zinc.

Write for Cleveland bulletins on automatic or die-casting equipment.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

CLEVELAND 3, OHIO

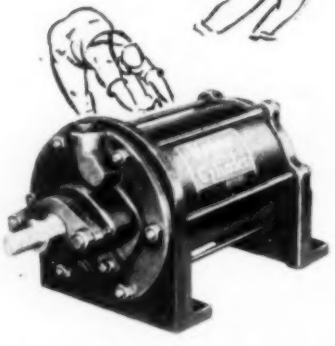
SALES OFFICES

CHICAGO: 1408 Civic Opera Building
DETROIT: 540 New Center Building
NEWARK: 902 American Insurance Building
CINCINNATI: 1315 American Building

Hanna *Air and Hydraulic* Cylinders

Use these Skilled Mechanics for

Pushing
Pulling
Pressing • Clamping

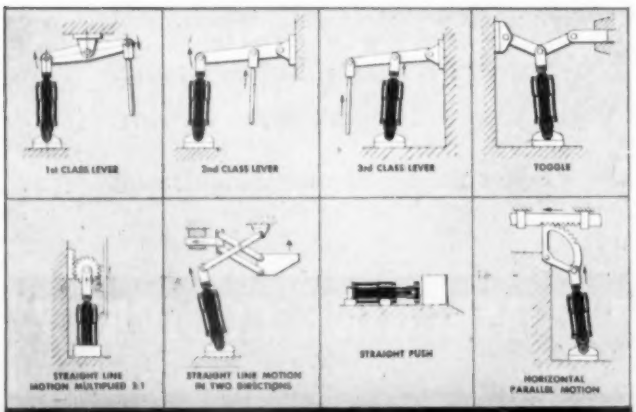


Much tedious and back-breaking manual effort and many inefficient operating methods can be replaced by Hanna Cylinder Power to save time, labor, promote safety, reduce costs and increase production.

There is a standard Hanna Cylinder to meet nearly every conceivable requirement as to mounting, length of piston stroke and application. Operating under pressures up to 1500 lbs., Hanna Cylinders may be used with air, oil or water, to exert a controlled push, pull or lift, whether through a lever, toggle or direct.

Check the machines and equipment you build and use in your plant. Chances are you will find places where Hanna Cylinders will do the job better, faster, at less cost.

Send for the new Hanna Catalog No. 233 covering Hydraulic Cylinders—and Catalog 230 giving full data on Low Pressure Cylinders.



HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO 22, ILLINOIS
AIR & HYDRAULIC CYLINDERS • RIVETERS • AIR HOISTS

Ettco-Emrick VISIBLE GRIP TAP CHUCKS

SEEING THE GRIP ASSURES POSITIVE DRIVE

This is one of the Ettco-Emrick High-Speed, Sensitive Tapping Attachments equipped with the Visible Grip Tap Chuck. Attachments come in 7 sizes for No. 0 to 1" taps. Can be used on any drill press. Hair-trigger sensitive friction clutch makes tapping easy. If you want full details, ask for BULLETIN No. 2.

These chucks assure correct insertion of taps every time. **First, the shank is centered on the round by tightening the knurled nut.** Then, with the key provided, the chuck's powerful floating jaws are clamped on the drive square — and correctly clamped because you can **see** the grip. Accurate centering and positive drive are assured — which means your tapping is more accurate, tap breakage is less likely, and damage to shanks and squares is practically eliminated.

For holding drills and other round shank tools, just grind a flat on one side.

Ettco-Emrick Visible Grip Tap Chucks come in 5 sizes for No. 0 to 1" taps. You can get them with taper holes for standard taper shanks or arranged to fit screw machine releasing tap holders, quick change collets or with straight shanks for turrets of hand screw machines.

WRITE FOR BULLETIN No. 6
It gives details of these common sense, universal tap chucks. Copy mailed on request. Write today.

ETTCO TOOL CO.

586 Johnson Ave., Brooklyn 6, N. Y.

Detroit 1 • *Chicago 6*

The Famous *Ettco-Emrick* DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

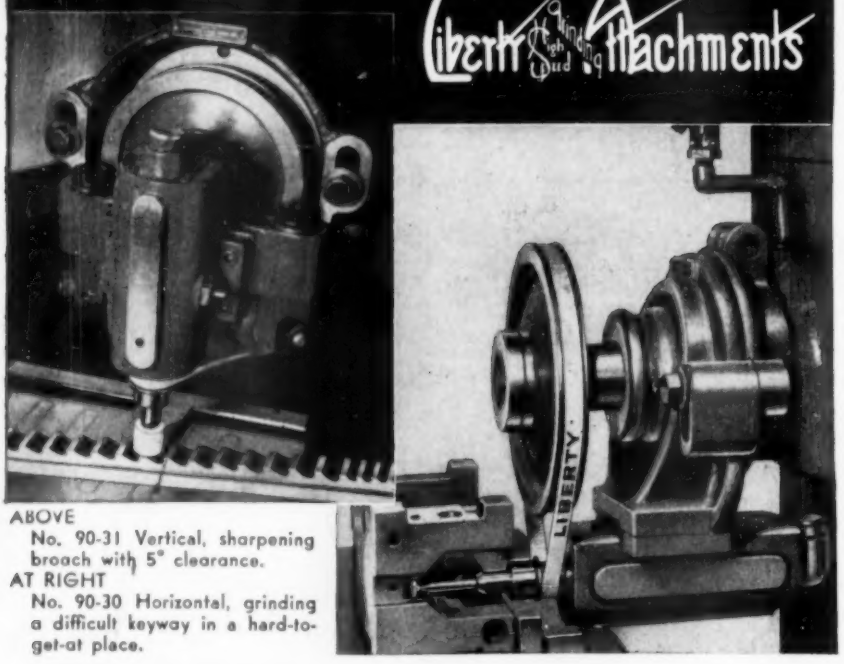
U.S. TOOL & MFG. CO.

A sixty page catalog will be sent upon receipt of a request on your letterhead addressed to U. S. Tool & Manufacturing Company, 6906 Kingsley, Dearborn, Michigan.

Specials

. . no tools can be better than the standards set for their inspection

Grinding Those Difficult Jobs with Liberty High Speed Grinding Attachments



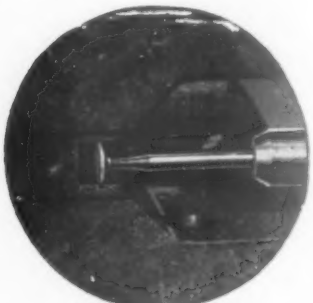
ABOVE
No. 90-31 Vertical, sharpening broach with 5° clearance.
AT RIGHT
No. 90-30 Horizontal, grinding a difficult keyway in a hard-to-get-at place.

Surface Grinders Do Double Duty

Liberty High Speed Grinding Attachments for surface grinders are precision tooled for greater accuracy on intricate and hard-to-get-at precision grinding jobs.

Write for Detailed Information

LIBERTY TOOL & GAGE WORKS INC.
233 Georgia Ave. Providence 5, R. I.



Close-up of operation shown at left.

Tomorrow's Tools for Today's Tasks

In War, as in Peace...

CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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PHILADELPHIA, PA., Castaloy Metal Sales Company.
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CERRO DE PASCO COPPER CORPORATION
40 WALL STREET - - NEW YORK 5, N. Y.

How TO SHORTEN SET-UP TIME!

The time required to set up a machine for a tapping or reaming job is reduced considerably if you use a Ziegler Floating Tool Holder.

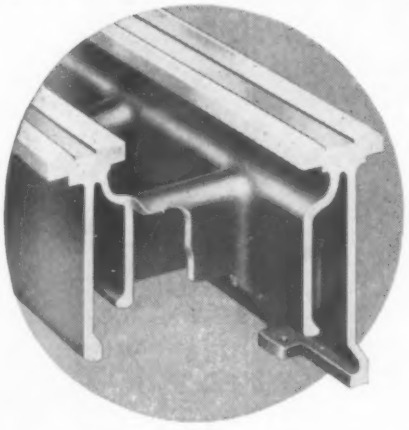
This is because, with a Ziegler Holder, the set-up does not have to be so accurate. Even if the spindle is out of alignment as much as 1/32", the Ziegler Floating Holder compensates for the inaccuracy, enabling the machine to perform perfect work.

W. M. ZIEGLER TOOL CO.
1920 TWELFTH STREET DETROIT 16, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

PROMINENT USERS OF



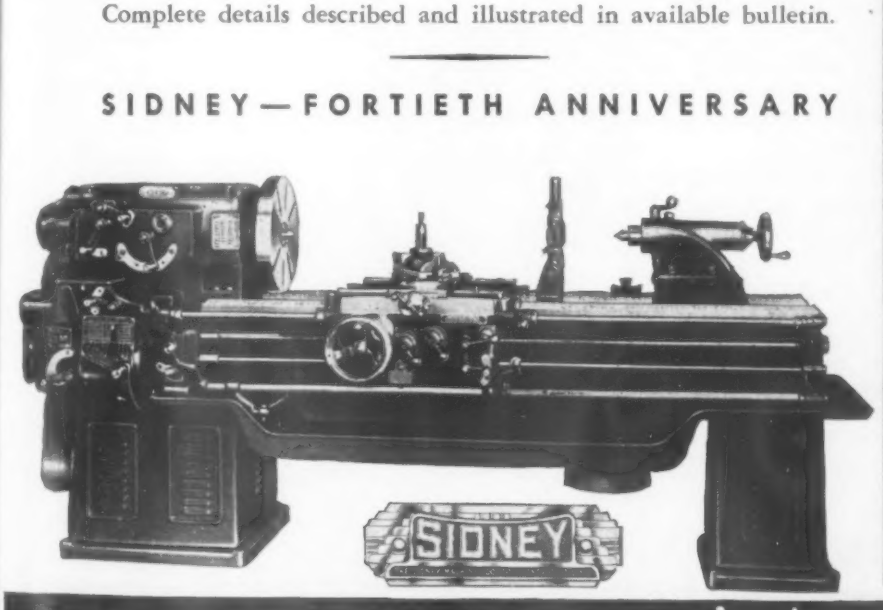
Sidney Lathes

RIGID BED DESIGN

Sound engineering is reflected in the design of the Sidney Lathe. Evidence of this is seen in the rigid bed construction. Four longitudinal walls (as illustrated) with cross girts at 12" intervals resist deflection and twisting strains. This type of bed improves rigid support to the various units—eliminates vibration—and assures continued accuracy.

Complete details described and illustrated in available bulletin.

SIDNEY—FORTIETH ANNIVERSARY



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INC., Fall River, Mass.
CONGOLEUM NAIRN, INC., Kearny, N. J.
Milwaukee, Wis.
ATCHISON, TOPEKA AND SANTA FE RAILWAY CO., Chicago, Ill.
RIVERSON & SON, INC., Philadelphia, Penna.
ELECTRO MOTIVE CORPORATION, Wilmington, Ohio
San Pedro, Calif.
JEFFERSON PROVING GROUNDS, Madison, Indiana
North Long Beach, Calif.
BELL AIRCRAFT CORP., Buffalo, N. Y.
GENERAL ELECTRIC CO., Schenectady, N. Y.
NAVAL AIR STATION, Quonset Point, R. I.
Quebec, P. Q.
ARSENAL, Watertown, Mass.
A. V. BERNEJI & CO., Wear Lynn, Mass.
VALVE CO., Ft. Wayne, Ind.
Pocatello, Idaho
CHICAGO BRIDGE & IRON WORKS, Chicago, Ill.
NAVY YARD, Philadelphia, Penna.
Bath, Maine
Philadelphia, Penna.
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WILDMANN & GODKNECHT, INC., Philadelphia, Penna.
LENS CO., Buffalo, N. Y.
Corry, Penna.
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FEDERAL SHIPBLDG. & DRYDOCK CO., Kearny, N. J.
SUPT. DOMINION ARSENAL, Lindsay, Ont.
MFG. CO., Frankford, Phila. Penna.
CAR CORP., Hamilton, Ontario
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AIR CORPS, Fort Riley, Kansas
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WRIGHT CORP., Caldwell, N. J.
of San Francisco, Calif.
BUDD INDUCTION HEATING INC., Langley Field, Hampton, Va.
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SHIPYARD, Houghton, Washington
COLUMBIA AIRCRAFT PRODUCTS, INC., Somerville, New Jersey
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OHIO SEAMLESS TUBE CO. ★

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NAVAL AIR STATION, Norfolk, Va.
NAVAL AIR STATION, Pensacola, Fla.
NAVAL AIR STATION, Quonset Point, R. I.
NAVAL AIR STATION, Seattle, Wash.
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NAVAL AIR STATION, Anacostia, D. C.
NAVAL AIR STATION, Lakehurst, N. J.
NAVAL AIR STATION, Waterfront, Mass.
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NAVAL AIR STATION, Los Angeles, Calif.
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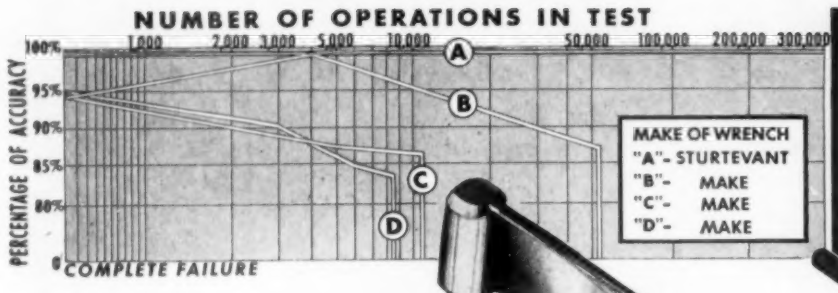
NAVAL AIR STATION, Alameda, Calif.

The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

SIDNEY — ESTABLISHED 1904 — OHIO



300,000 DEFLECTIONS and still Accurate

Over 100 models and types with capacities from 0-40 inch ounces to 7200 inch pounds.

STURTEVANT QUALITY

Permanently Accurate

TORQUE WRENCHES

As in any other measuring, limiting and inspecting tools, the first requisite of a torque wrench is accuracy. This accuracy should be permanent for few indeed are the users who have means of periodically checking the accuracy of a torque wrench.

STURTEVANT TORQUE WRENCHES are ***inherently accurate*** because they use the entire beam of the wrench as the measuring element and readings are direct—not through gears, levers or other error-compounding mechanisms. They will give you years of service because the beam is ground to uniformly spread operating stress along its entire length, and all deflection is well within its elastic limits. They are practically ***indestructible***, and can be handled like any other tool, on the bench, in the tool box, etc.—have no fragile dials, delicate springs or parts. That is why the majority of Torque Wrenches in use today are STURTEVANT TORQUE WRENCHES.

Write for Bulletin TW-28

P. A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Hammond

CHIP BREAKER and Diamond Finishing Grinder

★ HANDLES ALL SIZE CARBIDE TOOLS
★ ACCOMMODATES ALL ANGLES
★ FULLY PROTECTED AGAINST GRIT and SLUDGE
★ VIBRATIONLESS OPERATION THRU RUGGED HEAVY DUTY CONSTRUCTION
★ WEAR PROTECTED

This grinder — with its rugged, heavy machine tool type construction throughout — makes it unnecessary now to just "get by" with light inadequate equipment. Write for complete information and prices.

Hammond Machinery Builders INC
KALAMAZOO MICHIGAN

1636 Douglas Avenue
Eastern Branch 71 W. 23rd St.
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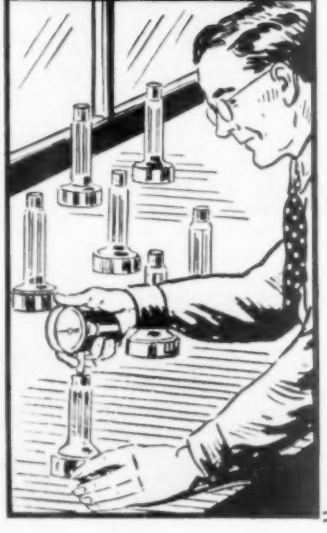
COMTORPLUG simplifies the gaging of precision bores



Simplified gaging with precision assured to fractions of .0001".

COMTORPLUG

Patented Internal Expanding Gage

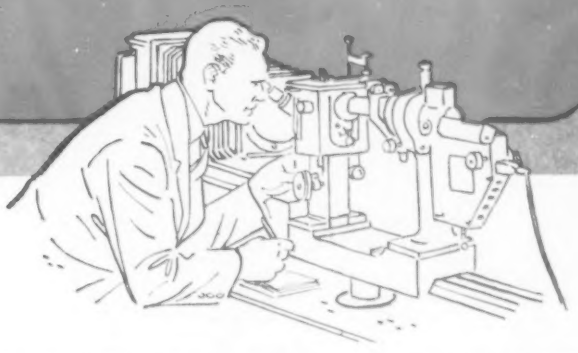
Sizes: ¼" to 7" and larger

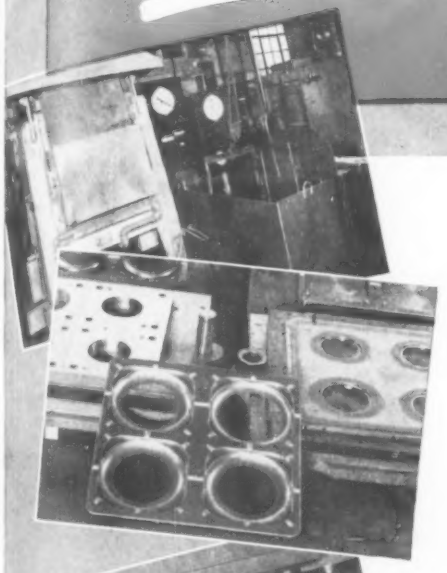
To provide in one instrument a gage simple and positive enough for use by machine operators, yet at the same time so highly precise that final inspectors place full reliance upon it—that is the accomplishment of Comtorplug. Unique features assure 2-point gaging of holes to fractions of .0001", showing size, out-of-round, front or back taper, bell mouth, barrel shape, etc. Airplane, automotive, ordnance plants depend upon Comtorplug to check critical bores.

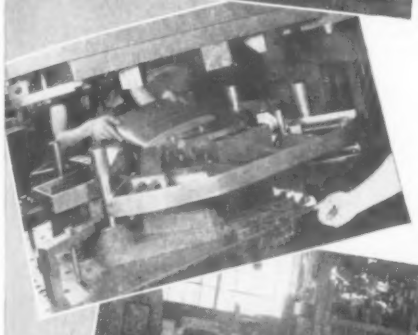
Request Bulletin 29

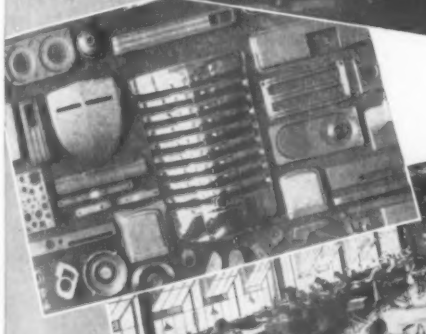
THE COMTOR CO.
70 Rumford Avenue
Waltham, Mass.

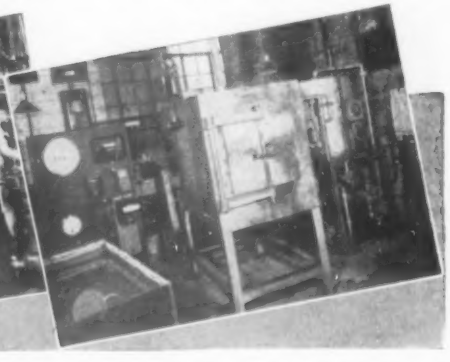
Exact KNOWLEDGE











THE Advance Die and Tool Company . . . committed to the building of best Sheet Metal Stamping Dies . . . determined to acquire *exact knowledge* of die making steels and alloys.

An extensive series of laboratory tests were conducted to scientifically determine those die making materials which—

Provide Longest Tool Life
Eliminate "Galling" or "Pick-Up"

During these tests, varying heat treating procedures were observed, providing the information necessary to heat treat die materials to the peak of their effectiveness.

Extraordinary performances of hundreds of Advance Dies in the nation's War Production Program attest to the value of *exact knowledge*. A single instance in which Advance punches were used for drawing steel cartridge cases is typical.

The operation required punches of great strength, freedom from galling and resistance to abrasion. Advance punches consistently produced 300% to 400% more cases than any other punches tried.

Advance Die and Tool Company are using its design and manufacturing facilities in the war effort for the duration . . . but, when peace comes, plan to use Advance *exact knowledge* in building your sheet metal stamping tools and dies.

ADVANCE DIE & TOOL CO.

6800 MADISON AVE. CLEVELAND, OHIO

COUNTERSINKING
CRANKSHAFTS

CIRCLE-R COMBINATION CENTER DRILLS WERE *"Made to Order"* For This Operation

TRADE R MARK

These drills are coping with one of the toughest crankshaft production jobs in the automotive industry. In this capacity a smaller size combined drill and countersink is used for spotting, followed up with a larger size drill.

CIRCLE-R CENTER REAMERS are helping to boost production in the airplane industry where they are used for countersinking of rivet holes. Circular Tool furnishes the majority of reamers used for this purpose.

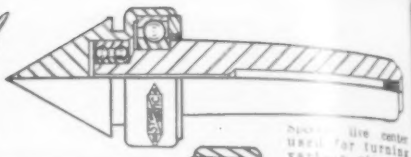
Send today for Circular Catalog — K

CIRCULAR TOOL CO., INC.
PROVIDENCE 5, R. I.

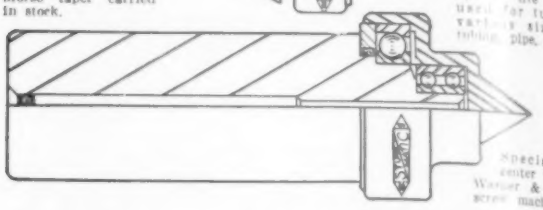
LOS ANGELES • ROCHESTER • INDIANAPOLIS • DETROIT
CHICAGO • PHILADELPHIA • NEW YORK • DAYTON
CLEVELAND • ST. LOUIS

Special

Standard shanks with Morse taper carried in stock.

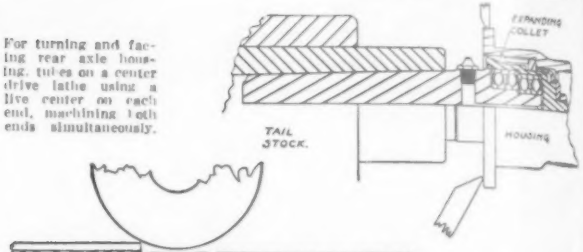


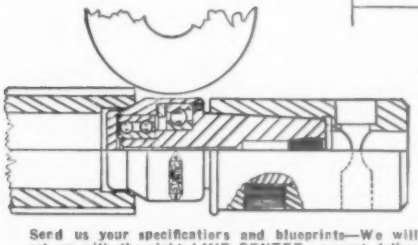
Special live center used for turning various sizes of tubing, pipe, etc.



Special live center used in Warner & Swasey screw machines.

For turning and facing rear axle housing tubes on a center drive lathe using a live center on each end, machining both ends simultaneously.





Special live center used for hobbing gears in a large automobile plant.

Send us your specifications and blueprints—We will see that your job is set up with the right LIVE CENTER—prompt deliveries on high priorities.

STURDIMATIC
TOOL COMPANY
5218 THIRD AVE. DETROIT, MICH.

"ROCKWELL"
HARDNESS TESTER

Shipment within a few days of these enormously improved new models

383 CONCORD AVE.
NEW YORK 54, N. Y.

WILSON
MECHANICAL INSTRUMENT CO., INC.

Gairing four flute step-multiple Tungsten carbide tipped cutter used in the production of parts for a marine engine.

Gairing Tungsten carbide tipped multi-diameter cutter for boring, facing and chamfering operations on airplane engine cylinder heads.

Gairing profile-ground radius cutter combining multi-diameter boring flutes and core drill used in the production of a tractor engine.

Tools that translate ideas into realities

The end cutting tools illustrated here are the net result of creative ideas that first existed in the minds of engineers; ideas about a marine engine, an aircraft engine and a tractor engine. These ideas were passed on to us for translation—for the design and manufacture of the *special* Tungsten carbide tipped cutting tools necessary for the practical, low-cost production of the metal parts required for translating ideas into realities.

We have been translating ideas into realities for more than a quarter century. Send us your sketches or outline drawings.

GAIRING

THE GAIRING TOOL COMPANY, DETROIT 32, MICHIGAN

MANUFACTURERS OF STANDARD, SPECIAL AND GAIR-LOCK INSERTED BLADE CUTTING TOOLS

Keep Your Surface Plates Accurate

Lombard re-scraping makes your old Surface Plates as good — and often times better-than new. All of the facilities which have made Lombard inspection plates a symbol for accuracy are now available for re-scraping, and machining old Surface Plates. This includes heat treating when necessary and essential hand work. Prices are reasonable and costs at a minimum. Prompt delivery.

LOMBARD GOVERNOR CORPORATION
300 MAIN ST., ASHLAND, MASS., U. S. A.

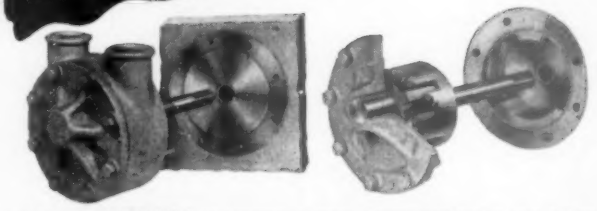
Speed Inspection in YOUR plant with this
EASY-TO-READ EASY-TO-USE Production Gage

Priced from $9.75 up

Would you like to know more about the new, war-born TRICO MICRO-CHEK now speeding up the gaging of millions of precision parts in over 3300 war plants? How inexperienced girls quickly become dependable inspectors? Send for our booklet which shows many applications of this accurate, speedier comparator gage.

TRICO
MICRO-CHEK
TRICO PRODUCTS CORP.
6 Trico Square, Buffalo 3, N. Y.

STRIPPED for Action!



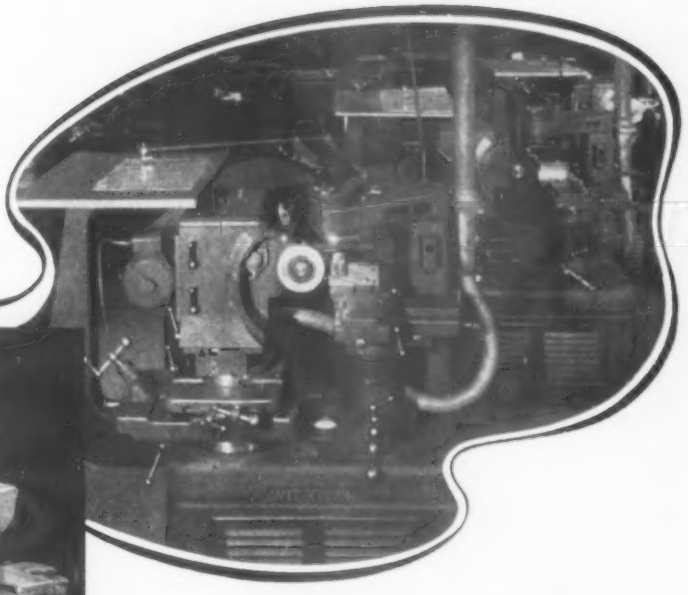
BUILD TUTHILL PUMPS INTO THE DESIGN OF YOUR MACHINE . . . SAVE SPACE, MATERIAL AND MONEY

For present or post-war requirements, it will pay you to incorporate Tuthill Stripped Pumps directly into the design of your machine. These internal-gear rotary pumps are furnished without mounting bracket or without housing as pumping elements only — for coolant, lubrication, hydraulic and liquid transfer service. They save space, material and money. Capacities from 1 to 50 g.p.m. Write for Tuthill Stripped Pump bulletin.

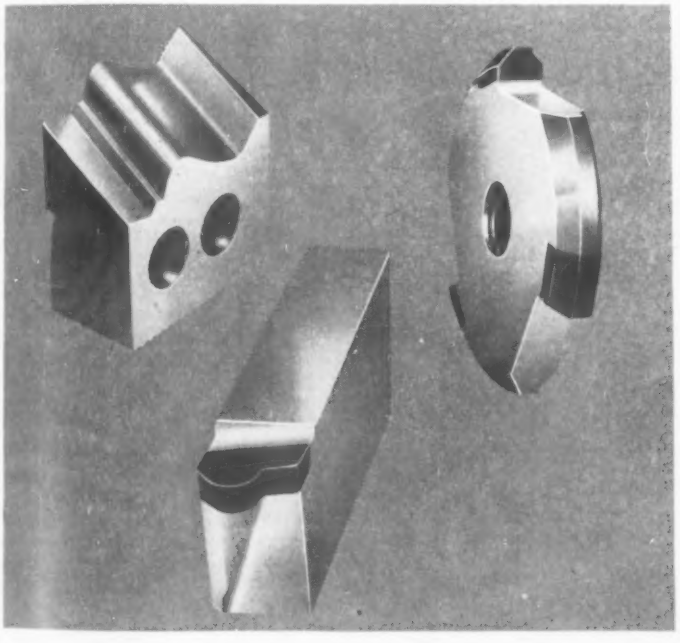
Tuthill Pumps are Serving Army • Navy Air Force Merchant Marine

TUTHILL PUMP COMPANY
939 E. 95th ST. • CHICAGO 19, ILLINOIS

Batteries of Wickman PRECISION PROFILE GRINDERS



Shown above is the Wickman Profile Grinder on which is mounted the circular grinding attachment supplied as an extra for use on cylindrical work such as circular form tools.



AS MANY AS 22 AMERICAN-BUILT MACHINES NOW OPERATING IN ONE PLANT

A true measure of the value of any machine tool can be found in the records of "repeat" orders. The Wickman Corporation customer list now shows a number of concerns who bought one Wickman Profile Grinder . . . and then placed orders for as many of these machines as were required to handle in their production all of the contour grinding work for which the Wickman machine is particularly suited. Every user has realized definite savings in both machining time and skilled manpower.

Shown at the left are three typical examples of work ground and inspected on the machine without use of radius dresser or formed wheel. While especially adaptable to cemented-carbide work, the grinding of contours in high speed steel as illustrated in the upper left is handled equally as efficiently.

FULL INFORMATION IS YOURS FOR THE ASKING

BUY WAR BONDS

THE Wickman CORPORATION

15535 WOODROW WILSON AVE.
DETROIT 3, MICHIGAN

New Life FOR OLD MACHINES

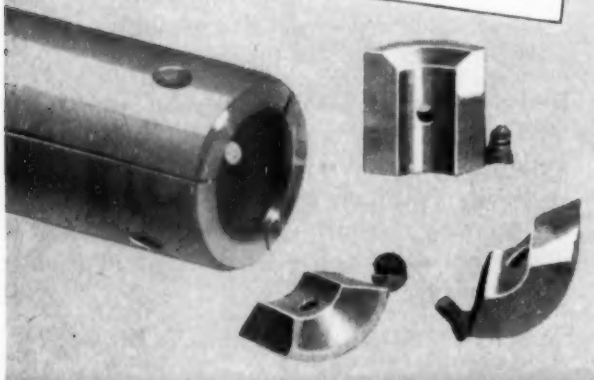
Diamond Grip Stops Slip

You can speed up old machines to tool capacity when you use Sutton Master Collets and Master Feed Fingers. Patented Diamond Grip holds any stock—round, hex, square—tightly with 10% to 15% less tension, cuts strain and wear on machine parts and tools, prevents slippage, cuts scrap.

Pads are interchangeable and replaceable, enabling you to handle almost any size stock with one Master Collet and one Master Feeder and a selection of different pads. Pads can be reground many times to restore size—a great money-saver.

Sutton Diamond Grip Collets cost no more than ordinary collets.

SUTTON TOOL COMPANY
2895 W. Grand Blvd., Detroit 2, Mich.
See our representative or send for Catalog No. 15.



SUTTON Diamond Grip **COLLETS**

BOYAR-SCHULTZ SMB BOLTS

It Is Cheaper To Use Good Bolts Than To Repair Costly Machines

HEAT treated alloy steels make them ***TOUGH*** for heavy work. Machined heads and carefully cut threads make them ***ACCURATE*** for the most exacting tool room work. Heads are machined square with bodies, presenting a clean, flat surface to the T-Slot. Work is held tightly under heavy machine cuts. Close adjustments are possible.

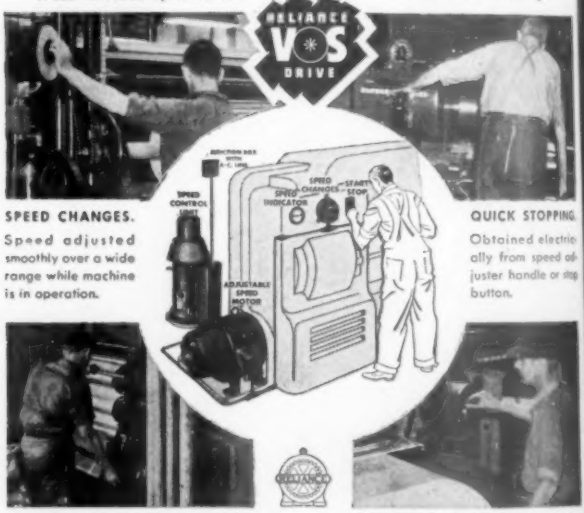
For best results use SMB Nuts and Washers. They are specially made for use with SMB Bolts.

Let Us Send You Our New Bolt Circular.

BOYAR-SCHULTZ CORPORATION
2116 Walnut Street Chicago 12, Illinois

AN *All-Electric* ADJUSTABLE-SPEED DRIVE
FOR A-C. CIRCUITS

SPEED RANGES up to 16 to 1 SIZES 1 TO 30 hp.



SPEED CHANGES. Speed adjusted smoothly over a wide range while machine is in operation.

QUICK STOPPING. Obtained electrically from speed adjuster handle or stop button.

SLOW FOR THREADING and INCHING. Safe for setting-up and for close inspection in process.

SMOOTH ACCELERATION. No clutches. Smooth acceleration and deceleration to protect light material in motion.

ALSO: A direct space-saving drive; speed-control convenience without limitations; reversing; start and stop without interfering with speed setting; ample starting torque.

Send for your copy of Bulletin 311 — FREE

RELIANCE ELECTRIC & ENGINEERING CO.
1088 IVANHOE ROAD CLEVELAND, OHIO
Sales Offices in Principal Cities

CUTS 23% MORE CHIPS *per hour*

with Monarch Automatic Feed Changes!

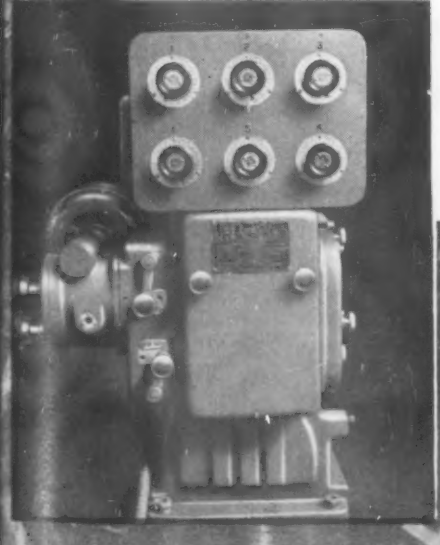
Machining time on this shaft was cut 23%, by using Automatic Feed Changes on a "Monarch Automatic Sizing Lathe". This substantial time saving is especially important today . . . and also indicates how costs can be cut with modern equipment. This 23% saving will be multiplied by the number of machines attended by each operator.

This specific job has five diameters, with feed rates automatically ranging from ½" to 2" per minute, determined by the depth of cut. Without Automatic Feed Changes, all diameters would be machined at the feeding rate for the starting diameter.

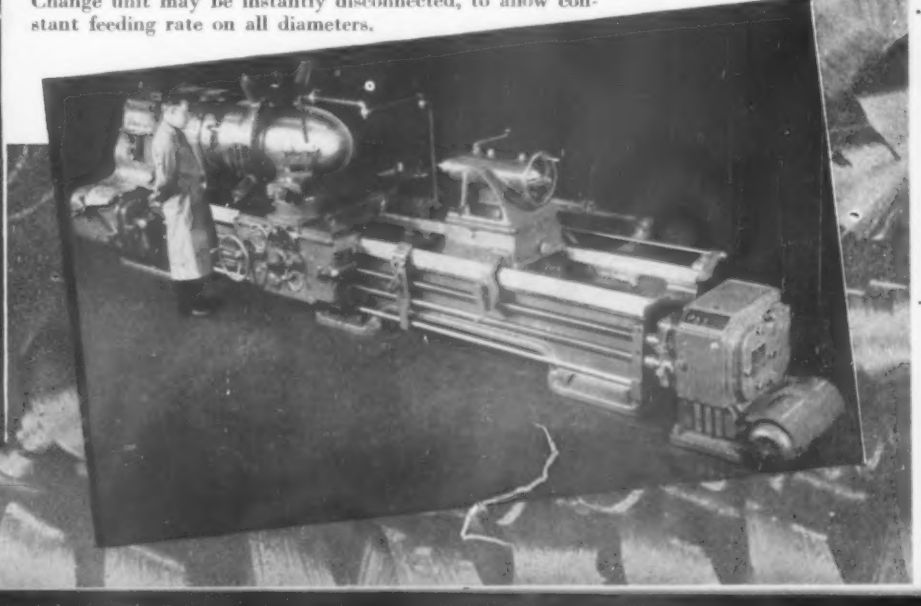
Monarch Automatic Sizing Lathes, with Automatic Feed Changes, have many applications for step shaft turning and similar work. Our engineers are at your service to see if their advantages can be applied to your work to save time and reduce costs.

THE MONARCH MACHINE TOOL COMPANY • SIDNEY, OHIO

MONARCH LATHES
Save Time



Automatic control mechanism is centered in the cabinet which houses the necessary rheostats to control the speed of the 4 to 1 d-c motor driving the entire feed unit. Any desired feed, from lowest to highest, is automatically provided for any or all diameters. Or, the Automatic Feed Change unit may be instantly disconnected, to allow constant feeding rate on all diameters.



FEDERAL *Taperlock* GAGE HANDLES

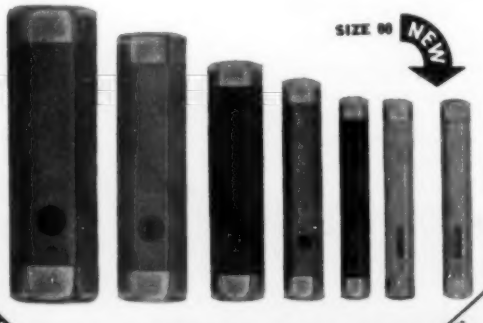
MADE of light weight plastic material, Federal Gage Handles are lighter than any metal used, even one-third lighter than aluminum. This lightness permits a most sensitive "touch" with less fatigue in long continued use; an advantage appreciated by women inspectors.

They are highly satisfactory with glass gages being so much lighter than metal handles, they reduce the danger of chipping and breakage.

Insulating properties help prevent transmission of bodily heat to gages which may affect accuracy.

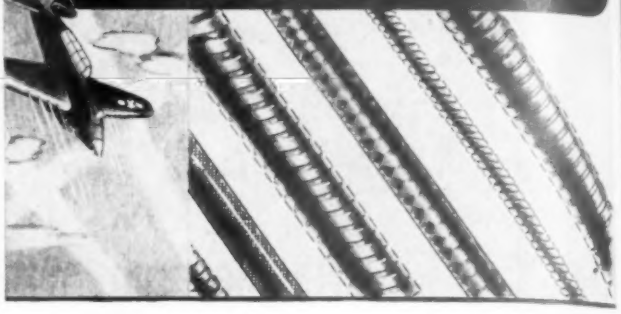
Marking for identification is accomplished with the same marking tools used for metal gages.

Immediate Shipments



FEDERAL TOOL CORPORATION
400 NORTH LEAVITT ST., CHICAGO, ILL.

WAR'S TESTS POINT THE WAY FOR POST-WAR REDESIGN WITH WALKER-TURNER *Flexible* SHAFTING!



Walker-Turner Flexible Shafting has thoroughly demonstrated its dependability in aircraft and other mechanical weapons—where requirements are especially severe. When the war emergency arose, this shafting was ready, having been used for many years in Walker-Turner Flexible Shaft Machines and in industrial machinery produced by other manufacturers. Today, in the redesign of mechanical products for post-war use, engineers are turning more and more to Walker-Turner Flexible Shafting as a solution to problems in light power transmission and remote control. Can we help you?

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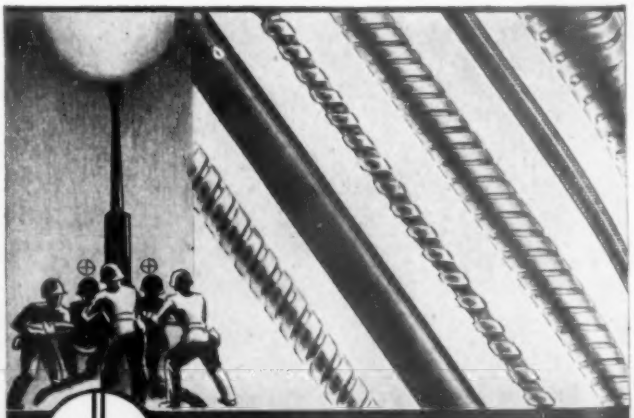
Berckman Street · Plainfield, N. J.



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FLEXIBLE SHAFTING
FOR REMOTE CONTROL AND POWER TRANSMISSION

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More and better work with fewer grinds *REXALLOY* . . . Crucible's Cast Cutting Alloy for "Middle-Range" Machining Applications

REXALLOY, Crucible's cast cutting alloy, completely covers that productive and cost-cutting range between the upper limits of high speed steel and the lower limits of tungsten carbide. Its high red-hardness and resistance to shock and abrasive wear often permit 25% to 100% increased speed, feed or depth of cut. In addition to greatly stepped-up production, ***REXALLOY*** almost invariably improves the quality of the finished product. Of equal importance in urgent war work is the fact that down time is materially reduced because this "Middle-Range" cast cutting alloy has such an exceptionally long cutting life between grinds.

A ***REXALLOY*** Service Engineer will gladly demonstrate in your own plant how completely ***REXALLOY*** covers the entire "Middle-Range" of your machining applications on all types of steel, iron, copper, brass, bronze, aluminum and similar metals. ***REXALLOY*** is available in standard tool bits, standard tipped tools, special tools, both tipped and solid, and castings. Mail the coupon today.

Buy More War Bonds

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☐ Please mail me your new book, ***"REXALLOY CUTTING TOOLS"***.

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Two Toggle Clamps, bolted to the tapping table, clamp lower die shoe securely in position for tapping operation. Swift toggle action provides instant release for quick relocation. No slow bolting or unbolting. . . . Many similar time-saving applications for machining, drilling, reaming, milling, welding, inspection and assembly operations. . . . De-Sta-Co Toggle Clamps are made in all sizes—all types.

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PLUS VALUE

Accurate, rugged, long-lasting HY-PRO Taps are packed in sturdy boxes separated in trays to protect their precision threads. Package acts as miniature tool box. Complete description on colored labels give exact contents of box for immediate identification and accurate stock keeping.

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New Bedford, Mass., U.S.A.

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Air Hardening, Non-Deforming, Cobalt High-Carbon, High Chromium Steel

In your change-over and re-tooling operations, we refer your Tool Engineer to PRK-33 Cobaltcrom. This alloy tool steel is the ideal material for extended runs and better production records.

We can ship forged discs and ring forgings promptly.

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highest grade tool steels

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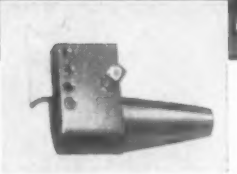

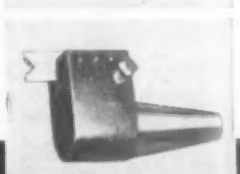

THESE tools make possible change to any kind of operation without the use of wrenches after set-up is determined. Fine height adjustment of all tools is maintained, regardless of change of tools from one operation to another or from lathe to lathe. Instant positioning and accurate repeating assured. Tools changed in 3 seconds. Rigid Holder, with 50% less overhang, is perfect for cemented carbide cutters, prolongs all tool life. Write today for Bulletin "A"

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KYLE-JOHNSON MACHINE CO.

1627 West Pico Boulevard • Los Angeles 15, California

(Above) Aircraft engine housing showing 56 holes within 22⅜" largest circle drilled on BARNESDRIL *H4 Hydram Machine.*

(Left) BARNESDRIL *H4 Hydram Drilling Machine equipped with 56 spindle auxiliary head and fixture for drilling holes in aircraft housing.*

(Right) Set-up of BARNESDRIL *H4 Hydram Machine for drilling 56 holes in aluminum housing.*

● This drilling job in an airplane aluminum housing is a typical example of the savings in machining and handling time possible by using BARNESDRIL Multiple Spindle Hydram Drilling Machines. A BARNESDRIL H4 Single Spindle Hydram Drilling Machine, equipped with a 56 spindle auxiliary head and fixture, drills 56 holes in this aluminum casting in one pass of the head. These 56 holes are located in three circles and are on 3 different planes. This H4 Hydram Drilling Machine is equipped with 8 quick change geared speeds, 20" spindle travel, hydraulic pump and valve mechanism, motor driven coolant pump, and has been furnished with increased column height with an electrically controlled dwell, and has a special large base with an in-and-out travel hydraulically operated table.

Three Sizes of Hydram Drilling Machines Available . . .

BARNESDRIL Hydram Drilling Machines for drilling, reaming, facing, and counterboring operations are available in 3 sizes. The H2 Hydram Machine has a drilling capacity of 2" diameter in any material, the H3 Hydram will drill up to 3" in diameter in any material, and the H4 Hydram has a 4" diameter capacity in solid drilling, while cast-iron can be bored and reamed up to 7" in diameter. These Single Spindle General Purpose Drilling Machines can be provided with Multiple Spindle Heads for drilling many and different sizes of holes with one pass of the machine.

FREE ADDITIONAL DATA . . . Complete specifications and additional data covering BARNESDRIL Hydram Drilling Machines are covered in this free bulletin. Write for your copy today. Ask for Bulletin No. T-134.

"Special" Production from Standard Machines . . .

Special production drilling is often accomplished by the application of a BARNESDRIL Standard Drilling Machine. These BARNESDRIL Standard Hydram Drilling Machines when provided with Multiple Spindle Heads will perform "special" machine production with equipment otherwise standard—resulting in relatively small investment and low operating cost.

Let BARNESDRIL Engineers analyze your production drilling problems and assist you in determining the correct machine for tooling. Just send part prints and complete data. There is no obligation.

Barnes Drill Co. 848-71 CHESTNUT STREET ROCKFORD ILLINOIS, U.S.A.

NEW EQUIPMENT

• Materials + Processing •

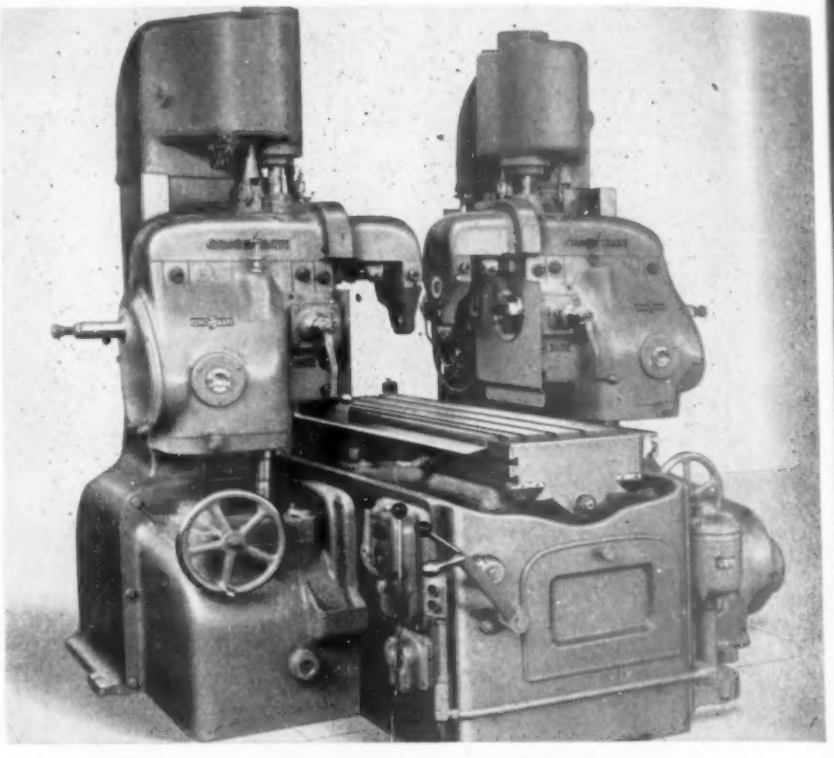
T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

AUTOMATIC MILLER DUPLICATES PROFILES (N60)

Accurate duplication of master profile templates is obtained automatically with a new tracer-controlled hydromatic line of milling machines recently announced by Cincinnati Milling and Grinding Machines, Inc.

No attention or effort on the part of the operator is required to obtain accurately controlled profile shapes, according to the company, and automatic table cycles, synchronized with spindle carrier vertical movements, reduce the effort of operation to that required to load and unload the work holding fixtures. The roller on the hydraulic tracer mechanism engages the master profile template attached to the work holding fixture, and any vertical movements imparted by the roller are automatically duplicated in magnitude by the spindle carrier.

Synchronization of table and spindle carrier gives automatic vertical advance and retraction of the cutter permitting lowering the cutter behind obstructions in the work or fixture for milling of blind end cuts. The automatic tracer control may be disengaged by means of a selector valve permitting use of the machine for heavy-duty work.



Tracer-Controlled Milling Machine for Automatic Profile Duplication

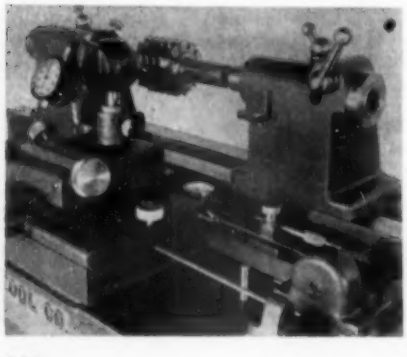
MACHINE CHECKS HOBS AND MILLING CUTTERS (N61)

Introduction of a new machine to completely check the correct resharpening of hobs or milling cutters has been announced by Michigan Tool Co.

The unit will check hobs or milling cutters with a maximum O. D. of 10", a maximum length of 8", and an arbor or shaft length maximum of 16" for spacing of flutes (either parallel or spiral gash), rake angle of flutes, parallelism of straight flutes, taper on the O. D., and concentricity of proof diameters. Checking is done by two standard interchangeable indicator assemblies, with two additional assemblies available for checking lead of hob or spacing of threads in multiple thread hobs, and for checking depth of tooth of topping hobs.

The setting of indicators for checking rake angle is simplified by use of a ground surface angle block mounted on the tailstock and used for initial indicator settings.

Hob and Milling Cutter Checker



INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

NEW INDEX FIXTURE IS MOTOR DRIVEN (N62)

U. S. Tool Co. Inc. has announced a new motor driven automatic indexing fixture.

The fixture is a self-contained unit with its own motor and is simply set on the milling machine table. One index plate to give a range of index is standard equipment, with extra plates for use with the fixture available for obtaining additional degrees of index.

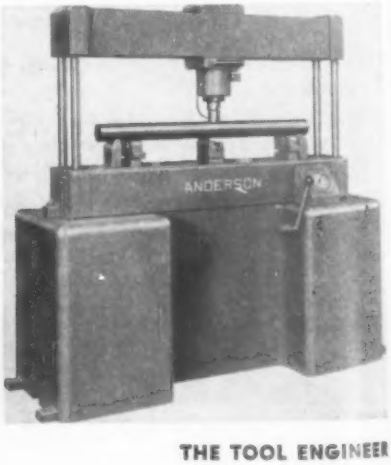
Motor-Driven Fixture

HYDRAULIC PRESS HAS TRAVELING RAM (N63)

A new hydraulic power press especially adapted for straightening cam shafts has been announced by Anderson Brothers Mfg. Co. The machine is

(Continued on page 166)

Hydraulic Power Press



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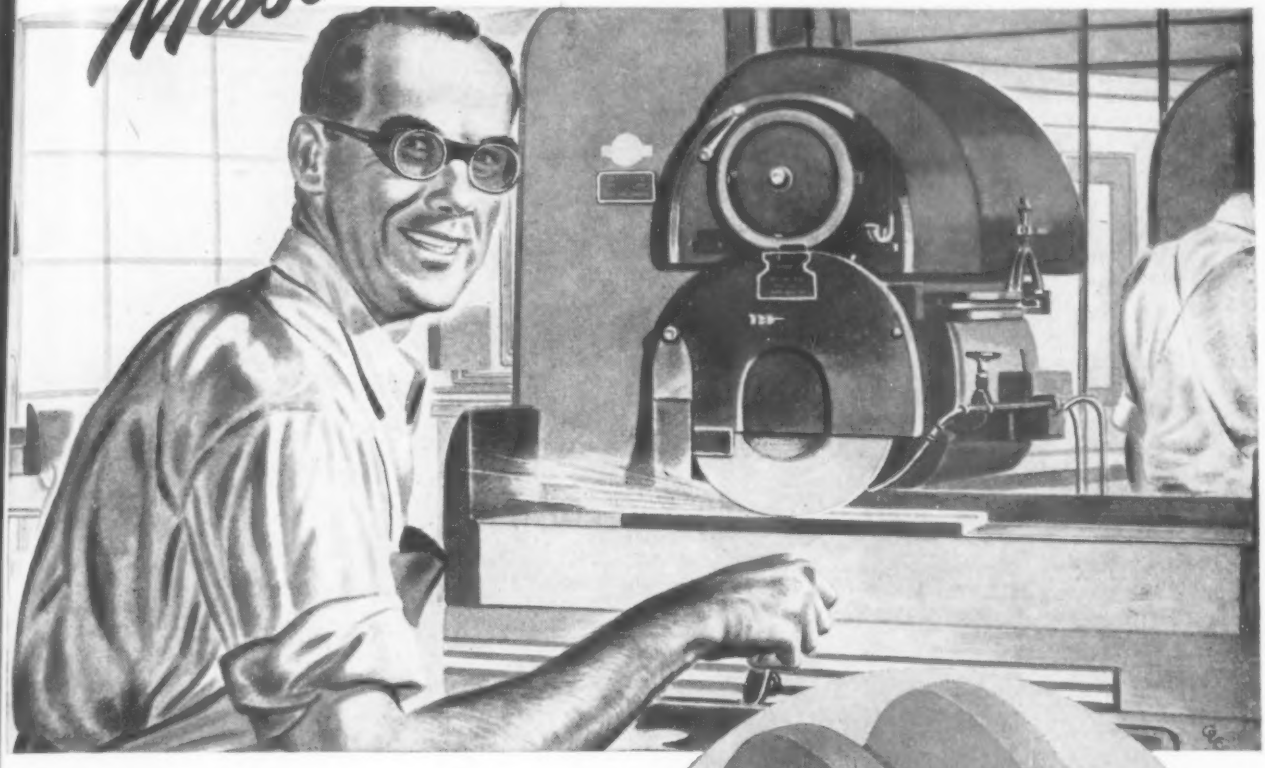
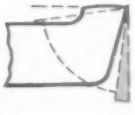
"Sure—I was from Missouri."

"Yes, I was from Missouri until I actually saw the Por-os-way wheel taking cuts of .008 to .125", saw it breeze along a 30" edge of ¾" armor plate in 2 minutes flat. That resulted in our turning out 10,800 pieces a month for Por-os-way against 4,320 formerly." If you're from Missouri, here's the precision wheel for you! And we ask you not to be satisfied with just better-than-your-usual performance. We urge you to be brutally skeptical and critical. Try this wheel as you've never tried any others! Give it the works! Send for the Por-os-way booklet "Facts About Por-os-way"—with the "prescription blank." Order a trial lot! Then make your toughest test yourself!



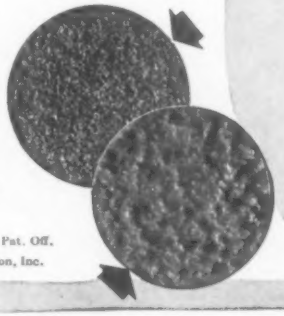
CHIP CLEARANCE DOES IT!



Just as a lathe tool needs clearance so that material may be removed without interference, so the tiny points of a grinding wheel require clearance. The unusual, very porous structure of the Por-os-way wheel provides chip clearance, NATURALLY, proved by long, curling chips. Wheel dressing is greatly reduced.

THIS MAKES THE DIFFERENCE

You can spot the difference between an ordinary wheel (top) and a Por-os-way wheel (bottom) with the naked eye. The extra porosity of Por-os-way is the reason for more than 8 distinct operating advantages.



Por-os-way porosity in many cases enables you to *rough grind* with the same fine grain wheel you intend to use for precision finishing. No time wasted on wheel changes or on extra finishing operations. No "special" finish wheel. Use Por-os-way for both jobs!

The List of Por-os-way Users Reads Like a Blue Book of American Industry, Included are:

E. C. Atkins & Company • Bell Aircraft • Edward G. Budd Mfg. Co. • Buick Motor Division of General Motors • Kinner Motors, Inc. • Studebaker Corporation • Thompson Aircraft Products • Wadell Engineering Company • Westinghouse Electric • Wright Aeronautical

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POR-OS-WAY*

A. P. DE SANNO & SON, INC., 462 Wheatland St., Phoenixville, Pa., Since 1893

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Radiac POR-OS-WAY • Radiac PARAFLEX • Radiac Mounted Points and Mounted Wheels

Radiac Internal Grinding Wheels • Radiac Abrasive Cut-Off Machines and Discs

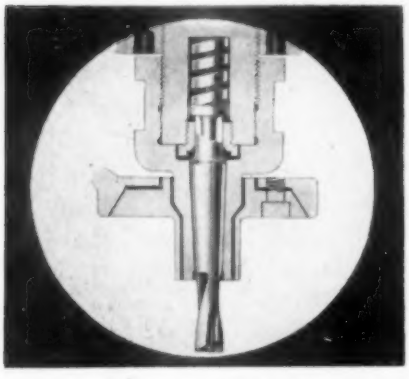
equipped with a traveling ram which is moved along on ball bearings, eliminating the need of moving the anvils, centers, and work.

According to the company, control is so sensitive that a shaft can be bent and inched along a thousandth at a time. The unit has a capacity of 10 tons but plans are under way for making a larger press with 25-ton capacity.

TAPER CHUCK REDUCES BREAKAGE OF BITS (N64)

Minimum bit breakage, perfect axial alignment, and proper centering of the tool at all times, are principal advantages of its inverted taper friction chuck, according to Onsrud Machine Works, Inc.

The chuck permits gripping of router



Onsrud Taper Chuck

bits immediately adjacent to the cutting edge, providing support for practically all of the tool's shank and counteracting the effect of side thrust developed by cutting pressure. Whip of the bit is eliminated, according to the company, preventing vibration and resultant bearing wear. A spring and pin unit employed to maintain pressure on the end of the bit provides a tight grip and eliminates slippage.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

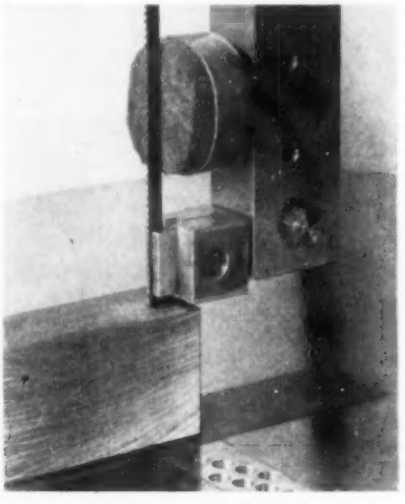
NEW PORTABLE MILLER DOES PRODUCTION WORK (N65)

A new portable milling machine, entirely self-contained with power unit and feeds and designed as a regular production tool for jobs which are impractical to handle on standard machines, has been developped by Giern & Anholtt Tool Co. Inc.

Worm gearing fitted onto the spindle provides reciprocating motion for the stroke, which is vertical from 0 to 3-½". The spindle travel has an equal speed in both directions. Other features include horizontal depth of cut from 0 to 2-½" with adjustable stop located at the rear of the slide, a ratchet feed capable of feed from .002" to .009" at each end of the stroke, a one hp motor which delivers speeds suitable for endmills ranging from $\frac{3}{16}$" to ½", and standard collet on the spindle nose.

SAW GUIDE EQUIPPED WITH LUBRICATOR (N66)

Grob Brothers announce that their newly developed saw guides provide a



Lubricated Saw Guide

bearing surface with a large number of various shapes to counteract pressure from the saw blade.

Made from special tough hard aluminum bronze, Rockwell C-34, the guides are equipped with a felt oiler mounted directly above the upper guide to assure long life. Other advantages cited by the manufacturer are faster cutting, elimination of damage to the saw blade from the rear, longer life of the saw blade, higher sawing accuracy, close support immediately above and below the work, better vision because of compact design, and quick and easy changeover for various width saw blades.

COUNTERSINK DESIGNED FOR LARGE RIVETS (N67)

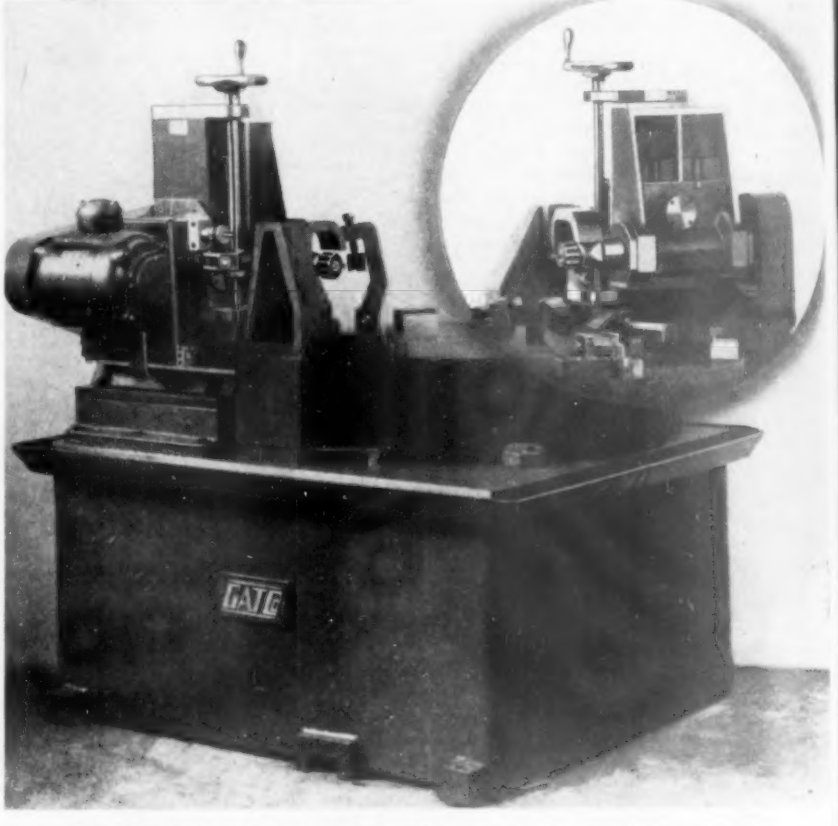
Capable of countersinking up to 1-¼" and handling ½" rivets, a new large size micrometer style countersink has been developed by the Aero Tool Co.

Designed for use with large rivets, bolts, and screws, the tool can be instantly and positively locked at each micrometer setting in increments of .001". Need of an adjusting tool is eliminated, since manual adjustments can be made while the tool is in operation. The standard tool includes a pre-

Oversize Countersink

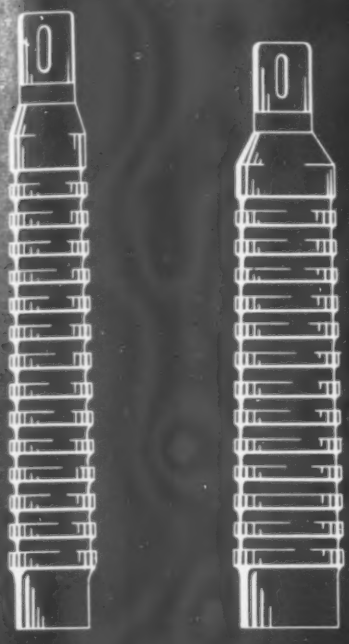
cision ground interchangeable cutter, 1" diameter and available in 72°, 78°, 82°, 100°, 110°, and 115° angles.

(Continued on page 168)



Portable Milling Machine With Self-Contained Power Unit and Feeds

BOTH these Broaches are the right length



1"	HOLE DIAM.	1½"
.030"	STOCK REMOVED	.040"
2"	EFFECT. LENGTH OF HOLE	2½"
0.375	CU. IN. PER STROKE	0.628

for the specific job each performs

How to get more out of your Broaches------

BY USING CORRECT BROACH LENGTH

There is a correct broach length for best performance on any job, depending on type of material to be broached, amount of stock removed, etc.

If the broach is shorter than this, it usually means a bigger step per tooth and you may have to sharpen more frequently, you may have increased tooth breakage, or finish may be inadequate.

If the broach is too long you lose productive time without gaining anything.

The job of correctly calculating the proper length of a broach for any given job is not difficult but it does require the availability of empirical data on actual broach performance on similar applications, similar materials, etc.

We will be glad to put at your disposal the experience we have gained in calculating and observing thousands of broach installations and recommend the correct broach length for best overall results in any given setup.

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DETROIT 13, U.S.A.

25th Anniversary
Broaches — Broaching Machines - Broaching Equipment

POWER FEED CONVERTS DRILL TO TAPPER (N68)

A new electrically controlled air power feed which makes precision automatic tapping possible on almost any type of drill press has been announced

Pneumatic Power Feed

by The Bellows Company.

The spindle of the machine is advanced or retracted by means of a solenoid controlled air motor. Feed and retraction speeds are independently controlled and are subject to wide variation, according to the manufacturer. The feed may be synchronized to solenoid controlled jigs, work feeds, and fixtures to make the entire operation automatic or may be set for multicycle operation with indexing fixtures and dial feeds.

Other features cited are reduced tip burning and drill breakage because of the automatic reduction of feed at the point of break-through, precise depth control to permit drilling or tapping blind holes to close tolerances, and foot switch operation to leave the operator with both hands free to insert and remove the work.

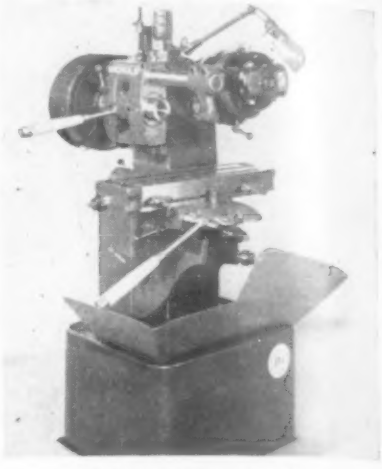
INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

NICHOLS MILLER IS REDESIGNED (N69)

A new base with deep channels and splash guards to provide control of coolant when high-speed milling is performed under a flood of cutting oil or compound, is one of the features incorporated in the new model Nichols milling machine, introduced by Nichols-Morris Corp.

Other features include a large capacity coolant tank and motor pump unit which slides out of the rear of the machine to facilitate drainage and chip removal; a new rugged streamlined column which provides support for knee, saddle, sliding spindle head, driving equipment, and controls; a thicker work table, ribbed to withstand excessive clamping pressures; and design of the knee so that rack-and-pinion



Nichols Milling Machine

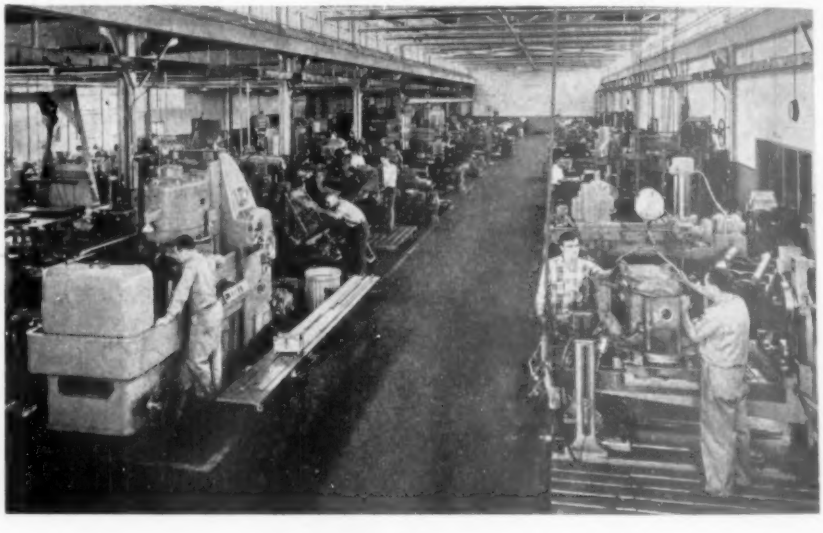
transverse can be substituted for the regular transverse feed screw. The machine is equipped for standard speeds up to 2400 rpm and special speeds up to 5000 rpm.

STELLITE-TIPPED TOOLS AVAILABLE IN TWO STYLES (N70)

Two new styles of tipped tools designed for applications employing tools that have a large cross section or that

(Continued on page 170)

PRODUCTION FACILITIES *Available Now!*



● Subject to prior engagement, this company offers certain facilities of one of the finest equipped machine shops in the Mid-West, for contract production. Some of our government contracts have now been completed, and we are in position to share the output of our equipment of new, modern turret lathes, 3¾" automatics, millers, grinders, boring mills, etc., with other manufacturers now engaged in military or essential civilian production.

In addition, our engineering and designing division can offer limited services in developing new machines or parts, and in modernizing pre-war models. *Write for literature and explain your problem.*

MERZ *Engineering Company*

INDIANAPOLIS 7, INDIANA

B Q FACE MILL

HELICAL SLAB AND END MILL

SLOTTING

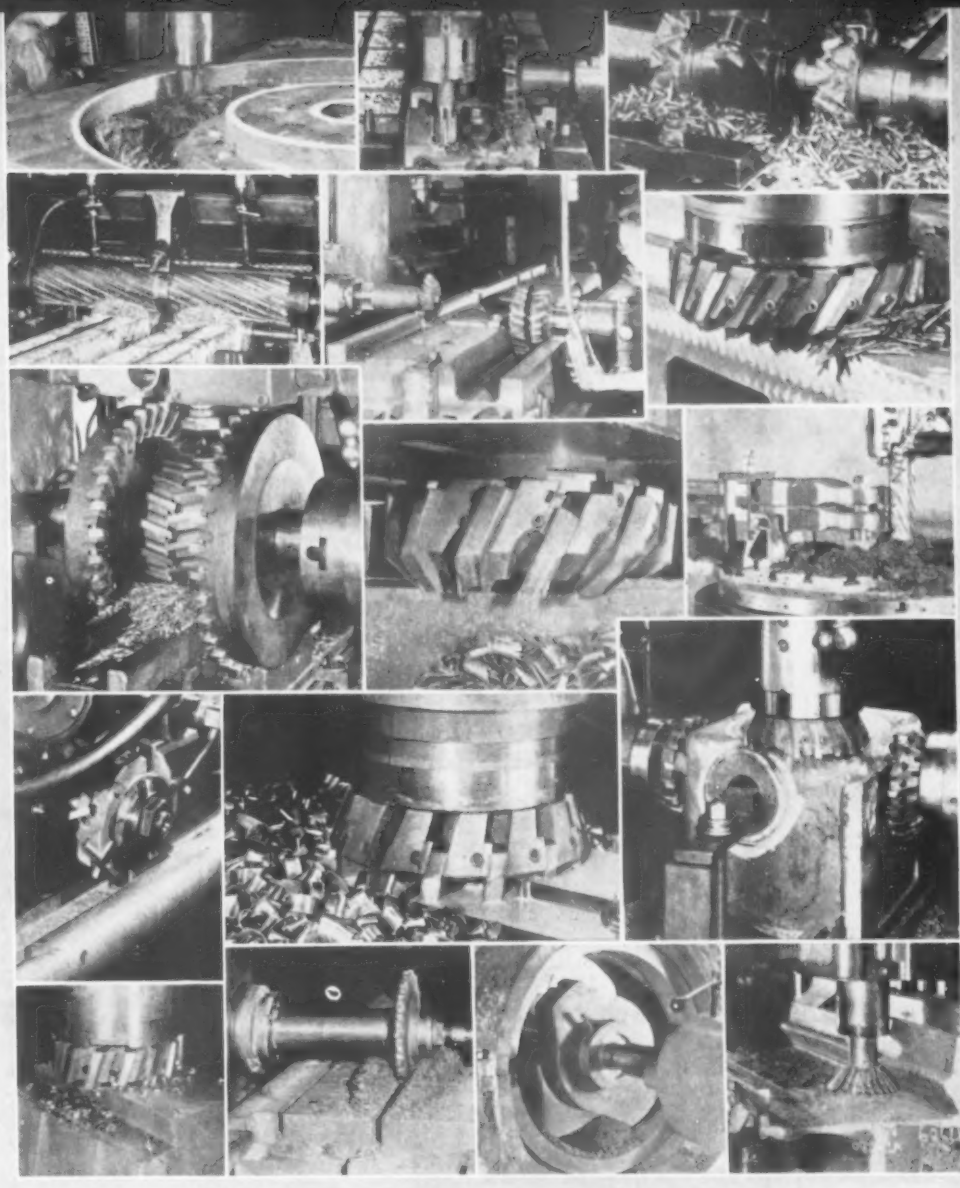
SIDE MILL

HIGH SPEED SHEAR CLEAR

TYPE N. B. FACE MILL

STAGGERED TOOTH CHANNELING

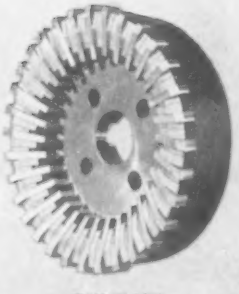
SPECIAL CARBIDE TIPPED



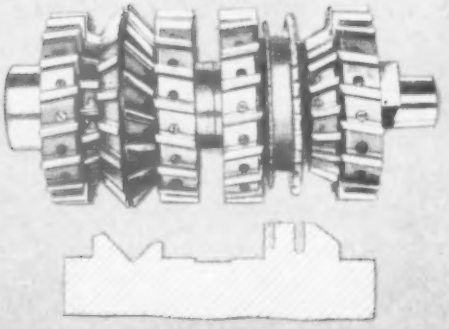
TYPE N X FACE MILL

SHEAR CLEAR FACE MILL

N X SOLID SHANK END MILL



RAY BLADE FACE MILL



CUTTER GANG

Present Ingersoll cutter designs have developed from over fifty years' experience in making tools for special Ingersoll milling, boring, and drilling machines. In addition to the standard types of inserted blade milling cutters for face milling, side milling, slotting slabbing and end milling, many special types of tools are available. Both types are illustrated above by themselves and at work.

Most of these tools may be furnished with either high speed steel, cast alloy, or carbide tipped blades. We also build solid cutters with brazed carbide tips and negative angle carbide cutters for milling steel.

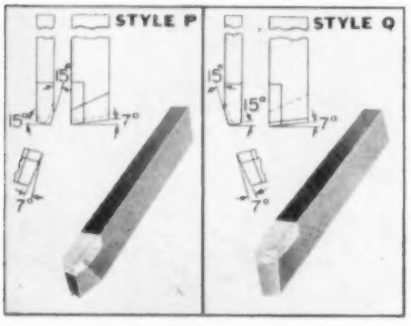
We will be glad to send you a booklet (Ingersoll Milling Cutter Engineering Specification Sheets) describing our standard inserted blade cutters. Your inquiries concerning special inserted blade tools will also receive prompt attention.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILL.

are bent or offset, and for tool holders which make use of solid tool bits impractical, have been announced by Haynes Stellite Co.

Designated as Style P and Style Q, the tools consist of a cutting tip of Stellite 98M2 cobalt-base alloy brazed or butt-welded to a tough steel shank, with proper clearance and lead angles ground for turning steel. In addition to being used for turning, boring, and facing operations, the tools also are used for various types of forming and grooving operations.

The tools are furnished with flat tops so that users can grind their own side rake angle for each particular job. They are ground with a 15° end cutting-edge angle, a 15° side cutting-edge angle, a 7° end relief angle and a 7° side relief angle. They are available in five sizes ranging from 5/8" x 1-1/4" x 8" to 1-1/4" x 1-1/4" x 7".



Stellite-Tipped Tools

EMBOSSING MACHINE MARKS COILED METAL STRIPS (N71)

Designed for quick changes in set-up and to accommodate either coiled sheet metal strips, pre-cut into tags of any

Matthews Embosser

desired size, or tags already cut to size, a new embossing machine has been developed by Jas. H. Matthews & Co.

The machine can be supplied to emboss as many as 16 characters at one time from 3/16" to 1/2" in size with each embossing bar limited to a maximum of 13 characters. Maximum metal thickness recommended for use with the machine is 24 gage, although [illegible] certain conditions heavier materials may be handled satisfactorily. The machine will emboss one line of characters only.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

GAGE SET DESIGNED FOR SMALL SHOPS (N72)

Designed expressly for use by tool and die makers whose output does not warrant purchase of a large set of gage blocks, a new small economy set of 37 precision gage blocks has been introduced by Continental Machines, Inc.

Packaged in a pocket sized carrying

(Continued on page 172)

DoAll Small Gage Set

HOW AMERICAN INDUSTRY PRODUCES MORE, FASTER, BETTER—WITH BOWSER EXACT LIQUID CONTROL

SIX CARS OF BLENDED AVIATION OIL

...in one-eighth the time!

This is the story of another of those it-can't-be-done jobs that helped turn the tide of battle.

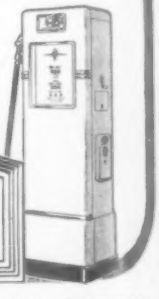
Wolf's Head Oil Refining Company, Oil City, Pa., got an emergency order for six cars of Navy aviation oil, a special blend that must pass rigid laboratory tests. It was a job that would, under ordinary methods, take over 40 hours.

With a Bowser Proportioner, pumping directly into the tank cars, Wolf's Head finished the work in a few minutes over *five hours*. And all tests showed perfect blending.

This Bowser Proportioner blends the many different grades of oil produced by Wolf's Head . . . and works with almost unbelievable speed and accuracy. Speed? It blends up to 175 gallons a minute (which is in excess of the rating specified by Wolf's Head.) Accuracy? Some of the proportions call for a single pint of one ingredient to 100 gallons of finished blend . . . one part in 800 . . . yet every test is "right on the nose."

That's typical of Bowser exact liquid control.

Here's another story . . . possibly closer to your own operation. A plant was shutting down broaching machines 10 minutes each hour to remove metal chips—25 pounds per hour—from the cutting oil sump. Various remedies failed. A Bowser Pressure Filter was installed. Now the machines run 24 hours . . . shut down 15 minutes. Production has increased 16⅔ per cent. BOWSER INC., Fort Wayne 5, Ind.



THE NAME THAT MEANS **EXACT CONTROL** *OF LIQUIDS*

BUY WAR BONDS

BOWSER ESTABLISHED 1885

Engineered

Circular Form Tools
for
Brown & Sharpe Machines

HARDINGE accuracy . . . special high speed steel . . . heat-treatment and ground finish assure proper part production.

HARDINGE Circular Form Tools are manufactured to your blueprint of the form tool or to a blueprint of the part to be produced.

HARDINGE Standard Circular Cut-off Tools are also available for Brown & Sharpe machines with varying blade thickness for different stock diameters or full machine capacity. These tools are threaded, hardened, ground and gashed . . . ready for use . . . and are packaged in individual containers.

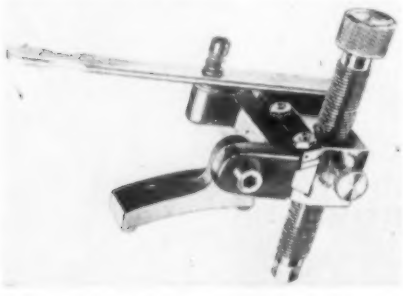
HARDINGE BROTHERS, INC.
ELMIRA, N. Y.

COLLETS – FEED FINGERS – PADS – FORM TOOLS
FOR ALL MAKES OF AUTOMATICS, CHUCKING MACHINES AND TURRET LATHES

case, the blocks are held on end for ease in handling and identifying and also to prevent grit and dust from settling on the polished measuring surfaces. Consisting of five series, the blocks when rung together give an overall measurement of 11.7995". Any measurement from .050" to 11.7995", in increments of .0001" can be made with millionth accuracy, using various size blocks in combination, according to the company.

WHEEL DRESSER MOUNTS AS INTEGRAL UNIT (N73)

A new "Jiffy" grinding wheel dresser, designed to become an integral part of the grinder on which it is



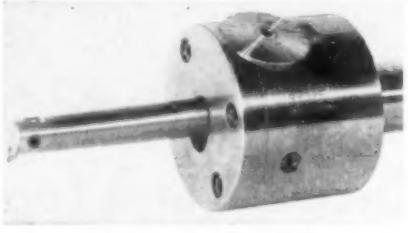
Grinding Wheel Dresser

mounted has been announced by American Standard Co.

It is not necessary to disturb the work setup when using the attachable dresser, according to the company, and the wheel can be dressed in five seconds. The tool always is ready for wheel dressing, regardless of the relative position of the wheel to the table.

ADJUSTABLE BORING HEAD REDUCES SET-UP TIME (N74)

Designed for use on both screw and milling machines, a new dial-set adjustable boring head has been developed by L. H. Harvey Associates. It can be adjusted without being removed



Dial-Set Boring Head

from the work by means of a large dial calibrated in 25 divisions of .001".

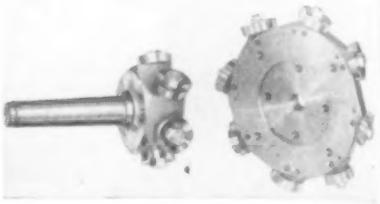
When used on milling machines, the boring-head, known as Borset, steps up production of fixtures and jigs since only a few seconds time is required to set the tool for successive cuts or for boring holes of any size within its range, according to the manufacturer. On screw machine operations, it reduces setup time for the final boring operation by making possible immediate micromatic adjustments while the machine is in operation. The Boreset is available in two sizes—No. 1 for bores from ½" to 1-¾" and No. 2 for bores from ½" to 2-¾".

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

MILLING CUTTER HAS CIRCULAR CUTTING EDGE (N75)

A new line of milling cutters having cutting bits which present circular cutting edges has been announced by Shearcut Tool Co.

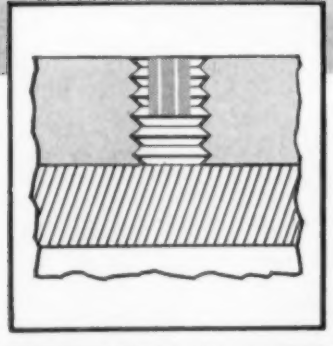


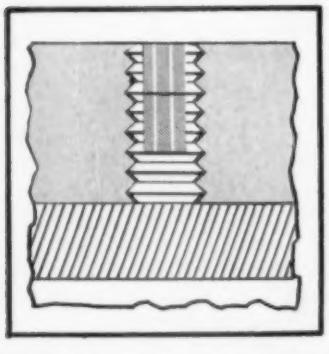
Circular-Edge Milling Cutter

According to the manufacturer, the cutters leave a mirror-like surface on almost any metal and will give several times the length of service obtainable from straight milling edge cutters.

(Continued on page 174)

DESIGNED FOR **Safety**... BUILT FOR **Strength**

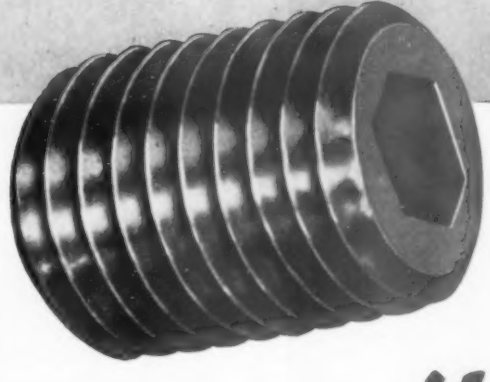




The advantages of hollow set screws include safety on revolving or moving parts, ease of assembly in confined places, and more compact construction.

Mac-it Hollow Set Screws offer these design features, plus great strength. They are heat-treated to resist upsetting of the point, rounding out of the hex sockets, and splitting of sockets at the corners.

The tremendous holding power of Mac-it Hollow Set Screws makes locking devices unnecessary in all but a few applications. In these cases, Mac-it Hollow Lock Screws are used like jam nuts to prevent any possibility of loosening.



Mac-its

PRONOUNCED "MACK-IT"

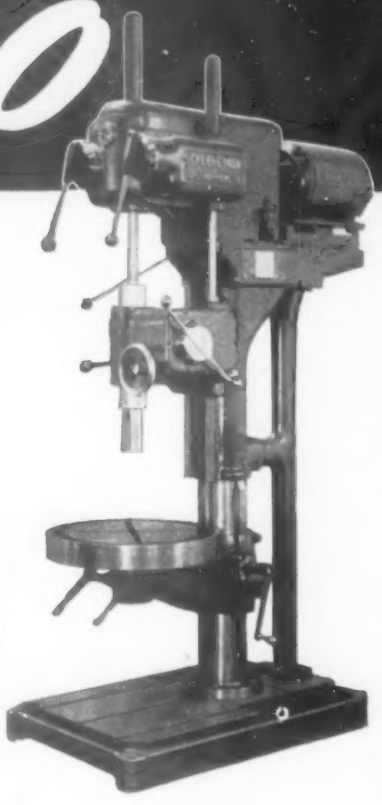
OTHER MAC-IT PRODUCTS INCLUDE:
Socket head cap screws, Stripper Bolts, Hollow pipe plugs, Hexagon head cap screws, Square head set screws

4341

Strong, Carlisle & Hammond Company • Cleveland, Ohio

One, or 1000

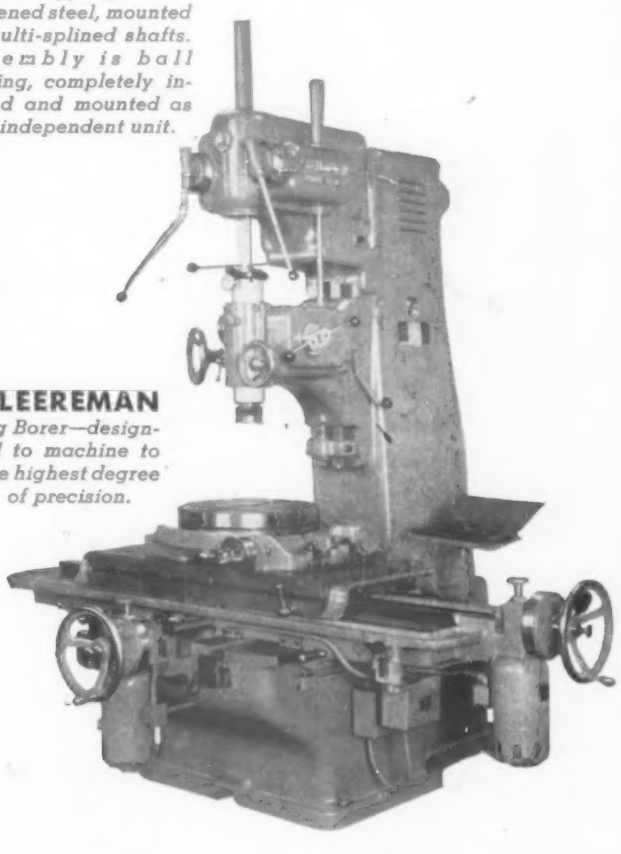
Whether you produce single pieces, or parts in large quantities; or make jigs and fixtures, you will want the efficiency, the precision, the high speed, the adaptability, and the long working life of Cleereman Drilling Machines and Jig Borers.



CLEEREMAN
Sliding Head Drilling Machine—made in Round Column and Box Column Types.

◄CLEEREMAN
Feed Gear Box—sliding selective type gears of hardened steel, mounted on multi-splined shafts. Assembly is ball bearing, completely inclosed and mounted as an independent unit.

Inspecting and assembling spindle and quill for Cleereman Jig Borers.



CLEEREMAN
Jig Borer—designed to machine to the highest degree of precision.

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BRYANT MACHINERY & ENGINEERING COMPANY

Associated with **CLEEREMAN MACHINE TOOL COMPANY**

General Sales Offices **400 W. Madison St. • • • Chicago 6 • Ill. • U. S. A.**

When a cutting edge has become dull, a rotation of the cutter a fraction of an inch presents to the work a new sharp cutting edge, the adjustment requiring less than a minute without destroying setup.

Known as "Shearcut," the cutter removes a curled chip. Other features cited for the tool by the company are that it may be rotated in either direction, welding is eliminated, heavy cuts may be taken, it cannot dig in or chatter, and less cutting heat is generated.

INSERTED-BLADE CUTTERS EASILY MAINTAINED (N76)

A line of inserted-blade cutters that permit high-speed carbide milling of steel with the same smoothness of operation attained with multiple blade cutters and yet are simple to maintain, has been announced by Kennametal, Inc.

Inserted Blade Cutter

Tool and cutter grinders are not necessary, since blades may be removed from the cutter head and resharpened to a template on a simple, adjustable-table carbide grinder, according to the company. Since each blade cuts an independent path, accurate resetting in the head is not necessary. Known as Kennamills, the cutters are available in four sizes: the 2" size with 3 blades; and 3", 4", 5" sizes each with 4 blades. The company states further that use of the cutter permits full utilization of the horsepower available on modern milling machines on depth of cuts over ¼" deep.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

MARKING MACHINE HAS WIDE RANGE (N77)

A new pedestal-type power-operated marking machine has been announced by The Acromark Company.

Designated as No. 9AMP, the machine is available with a wide range of accessories. These include specially formed cradle rolls to hold cylindrical pieces of odd shape or contour, mandrels or stud mountings to hold hollow cylindrical parts, and a rotary type holder for marking flat parts.

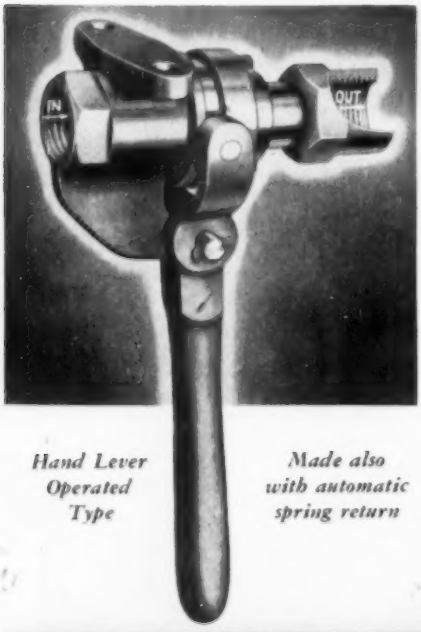
Power Marking Machine

Operation is extremely simple, the company states, since the part to be marked is placed on the cradle roll and the flat die or type is passed over it. Production marking may be done by unskilled help.

FLYWHEEL ARBORS DAMPEN VIBRATION (N78)

A line of simple flywheel arbors or adaptors designed to dampen vibration or fluttering caused by intermittent cutting of carbide or fly cutters is announced by Weddell Tools, Inc.

(Continued on page 176)



Hand Lever Operated Type

Made also with automatic spring return

Faster Easier Operating

• Q. A. W. valves are practically instant-acting, due to short valve-sleeve travel and "balanced" condition, never working against pressure. No metal-to-metal contact, no seats or glands ever to require grinding, nothing easily to get out of order, Q. A. W. valves give amazingly long wear and trouble-free service.

Send for Catalog and Data Book

C. B. HUNT & SON

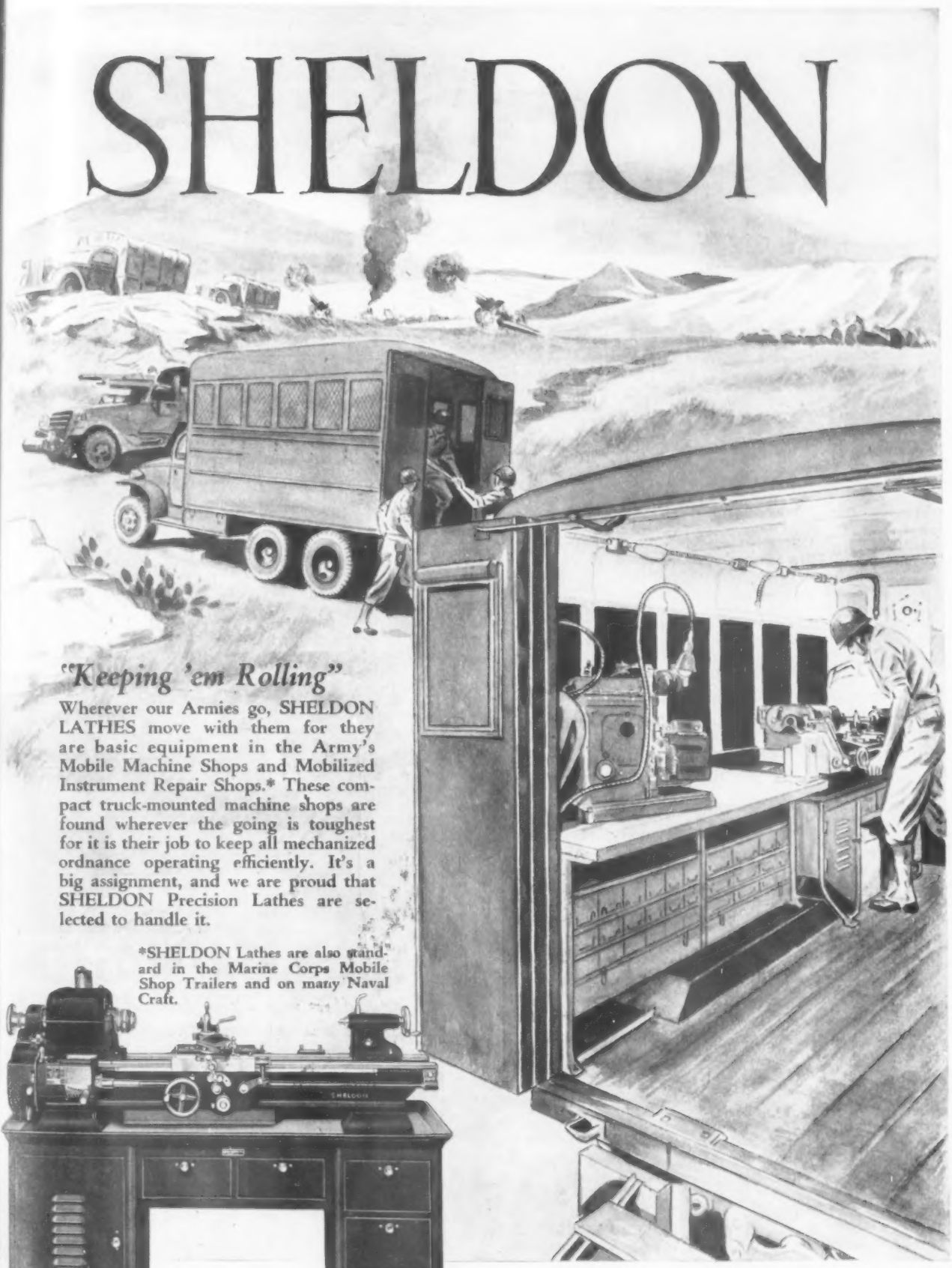
1868 E. PERSHING ST. SALEM, OHIO

Q. A. W. Valves may be adapted to Hand • Foot • Solenoid • Diaphragm • Pilot • Lever or Cam Control

QUICK-AS-WINK CONTROL VALVES

THE HIGHER THE PRESSURE AIR WATER OIL THE TIGHTER THE SEAL

SHELDON



"Keeping 'em Rolling"

Wherever our Armies go, SHELDON LATHES move with them for they are basic equipment in the Army's Mobile Machine Shops and Mobilized Instrument Repair Shops.* These compact truck-mounted machine shops are found wherever the going is toughest for it is their job to keep all mechanized ordnance operating efficiently. It's a big assignment, and we are proud that SHELDON Precision Lathes are selected to handle it.

*SHELDON Lathes are also standard in the Marine Corps Mobile Shop Trailers and on many Naval Craft.

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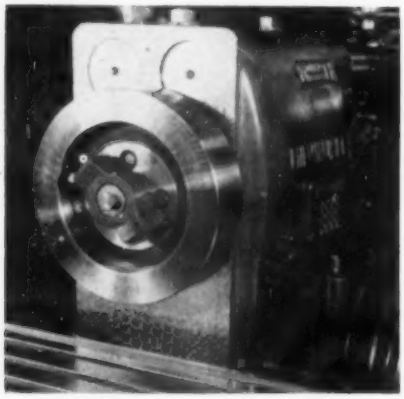
CATALOGUE

SHELDON MACHINE CO., INC.

4252 N. KNOX AVE., CHICAGO 41, U.S.A.



Weddell Flywheel Arbor

In operation, the flywheel arbor replaces the standard shell-end mill arbor which mounts on the spindle of the machine. This combination arbor and flywheel has a nose which is a replica of the nose end of the shell-end mill arbor on which the milling or fly cutter is fastened and driven.

For use with cutters that fit directly on the spindle, a flywheel spindle-nose adaptor is available. The back is counterbored or adapted to fit the machine spindle nose, while the front is the same as the machine spindle nose, permitting the mounting of a standard cutter. Adaptors are available that permit use of taper-shank cutters. According to the company, use of the flywheel cutters or adaptors allows lighter-bodied, less expensive, and more easily handled cutters, to be used. They are available in standard or special sizes and shapes.

INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

PNEUMATIC FILING MACHINE DOES FINE FINISH WORK (N79)

Keller Tool Co., announces a new small pneumatic filing machine for doing fine finish filing in shops making casting dies, plastic molds, and similar products. The tool also can be used as a portable power saw for making irregular saw cuts by substituting a hack saw blade for the usual file, the company reports.

Features of the tool include a rotary air motor, a new cam and piston utilizing a ball bearing assembly to transfer the rotary motion of the motor to the reciprocating motion of the file, and use of a standard ball bearing set at an angle of 27 degrees with a cam angle of 25 degrees to assure contact between the cam and the outer ball race. The inner race is fixed to the piston and does not contact the cam surface. The tool is available in one size with a free speed rating of 1500 strokes per minute and with a fixed length of file stroke of $\frac{7}{16}$".

Pneumatic Filer

VISUAL GRINDING GAGE ELIMINATES HAND MIKING (N80)

Increased grinding speed, fewer rejections, less waste, and greatly reduced operator fatigue are principal features cited by Clawson & Bals, Inc., for their new micromatic visual grinding gage.

Micromatic Grinding Gage

The instrument has no gears, levers,

(Continued on page 178)

IT'S NO TRICK AT ALL WITH TORIT

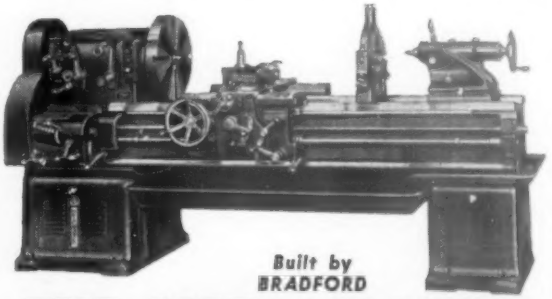
TORIT DUST COLLECTORS

In industrial cutting, grinding, and polishing operations abrasive dust is a menace to valuable machinery and the health and efficiency of employees.

TORIT Dust Collectors clean and recirculate air in one operation. Being portable and completely self-contained they fit into present and future production layouts. For complete information write:

TORIT MANUFACTURING COMPANY
281 Walnut St.
St. Paul 2 Minn.

TORIT Dust Collectors
SELF-CONTAINED UNITS



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THE METALMASTER

Lathe offers you a combination of outstanding features of construction and design.

1840 - 1944

Bradford's experience in building metal-working machinery covers more than a century.

Spindles are high-carbon molybdenum steel... gears are high quality alloy steel, heat-treated and shaved and lapped to close tolerances... ways are carefully planed and scraped... the range of threads and feeds is infinite... power is ample....Deep walls, well braced, prevent springing under heavy cuts.

Also manufacturers of drilling and tapping equipment

THE BRADFORD MACHINE TOOL CO.
EVANS STREET SOUTH OF EIGHTH CINCINNATI, OHIO
PRECISION TOOLS SINCE 1840

WITH TRU-LINE TOOLS *You Save* 4 WAYS!

TRY a TRU-LINE Engineered Diamond Tool and you'll learn first hand why production men everywhere are turning to TRU-LINE. For TRU-LINE Diamond Tools engineered to your job will give you all these savings in time and money:

YOU'LL SAVE because the TRU-LINE multiple diamond tool requires no turning. That means less machine down time—greater production.

YOU'LL SAVE because of the unique feature of placing the diamonds in overlapping rows. This provides a continuous cutting surface for the life of the tool.

YOU'LL SAVE because the thin blade that dissipates heat rapidly is made of our own alloy that forms a rugged, chemical bond with the diamonds, thus permitting the diamonds to be used up entirely.

YOU'LL SAVE because the use of smaller, high quality, carefully selected diamonds means much lower tool costs.

There is a TRU-LINE Tool for every type of straight, profile or step dressing operation—one that will bring to your job faster production, greater accuracy and remarkable savings in wheel dressing costs. Try one TODAY!

WHEEL TRUEING TOOL COMPANY

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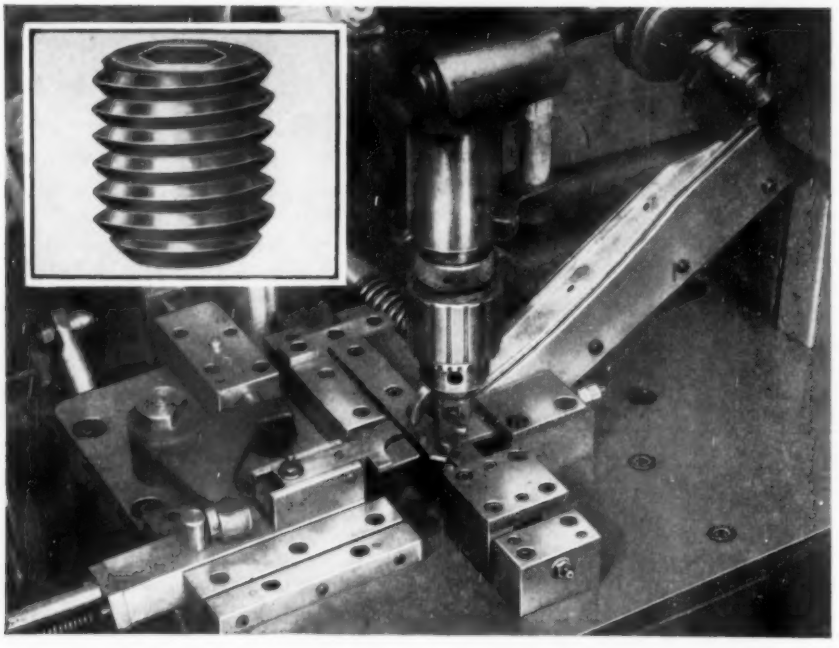
DETROIT 6, MICHIGAN

HAVE YOU RECEIVED A COPY OF THIS BOOK?

It gives complete details, illustrations and prices of this complete line of money-saving diamond wheel dressing tools. Write for your free copy today.

★ ★ ★



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HOLDING-POWER in machine·tool set-ups

"Tru-Ground" DOWEL PINS

STRENGTH for set-ups with weld-like grip, not to be budged by severest operational stresses. Applications easily adjusted with Allen Hex Keys; handily reached in the hardest-to-get-at places. Adapted to high-speed assembling with power drivers... The screws are threaded by new, special processes maintaining pitch diameter within high Class 3 limits. Complete frictional contact between screw threads and tapped threads stops tendency to "unwind" under vibration... Order ALLENS to specify these advantages all at once!

Allen Hollow Screws distributed only through local Industrial Distributors in all centers.

THE ALLEN MANUFACTURING COMPANY
HARTFORD, ★ ALLEN ★ CONNECTICUT, U.S.A.

or angles and may be applied to and taken off the work while the machine is in operation. A dial indicator guides the operator as the work is ground to size, and the gage indicates the correct size even though the sizing controls of the machine may be worn, the company states. Hand "miking" is eliminated.

The gage is available in two models, having ranges of ⅛" to 1-¼" and 5/8" to 2-½" respectively. Additional calipers for the larger model provide ranges of 2" to 5" and 5" to 8".

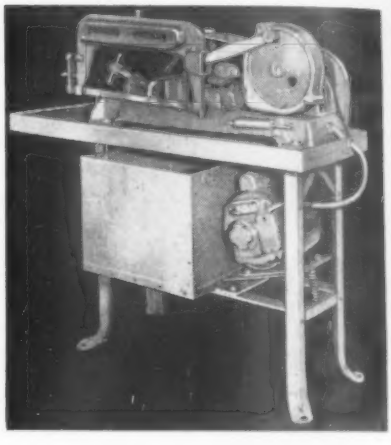
INFORMATION FREE

For complete information on equipment listed in this section, list the key number preceding each item and your name and address on postcard coupons—page 163.

POWER HACKSAW DESIGNED FOR AUXILIARY USE (N81)

A new power hacksaw, designed primarily for use in departments remote from the sawing room and as an auxiliary and standby unit, has been announced by Covel Mfg. Co.

Adapted for either wet or dry sawing, the machine will handle any work



Covel Power Hacksaw

up to 4" square stock. A quick-acting vise holds the work securely in place and the desired cut can be made at any angle up to 45°. The saw will handle soft materials such as aluminum, Bakelite, fibre, cast iron, and similar materials at the rate of 80 strokes per minute. Medium materials such as annealed tool steel, alloys, and similar substances are cut at the rate of 60 strokes per minute. A rate of 40 strokes is possible on hard materials, such as spring steel.

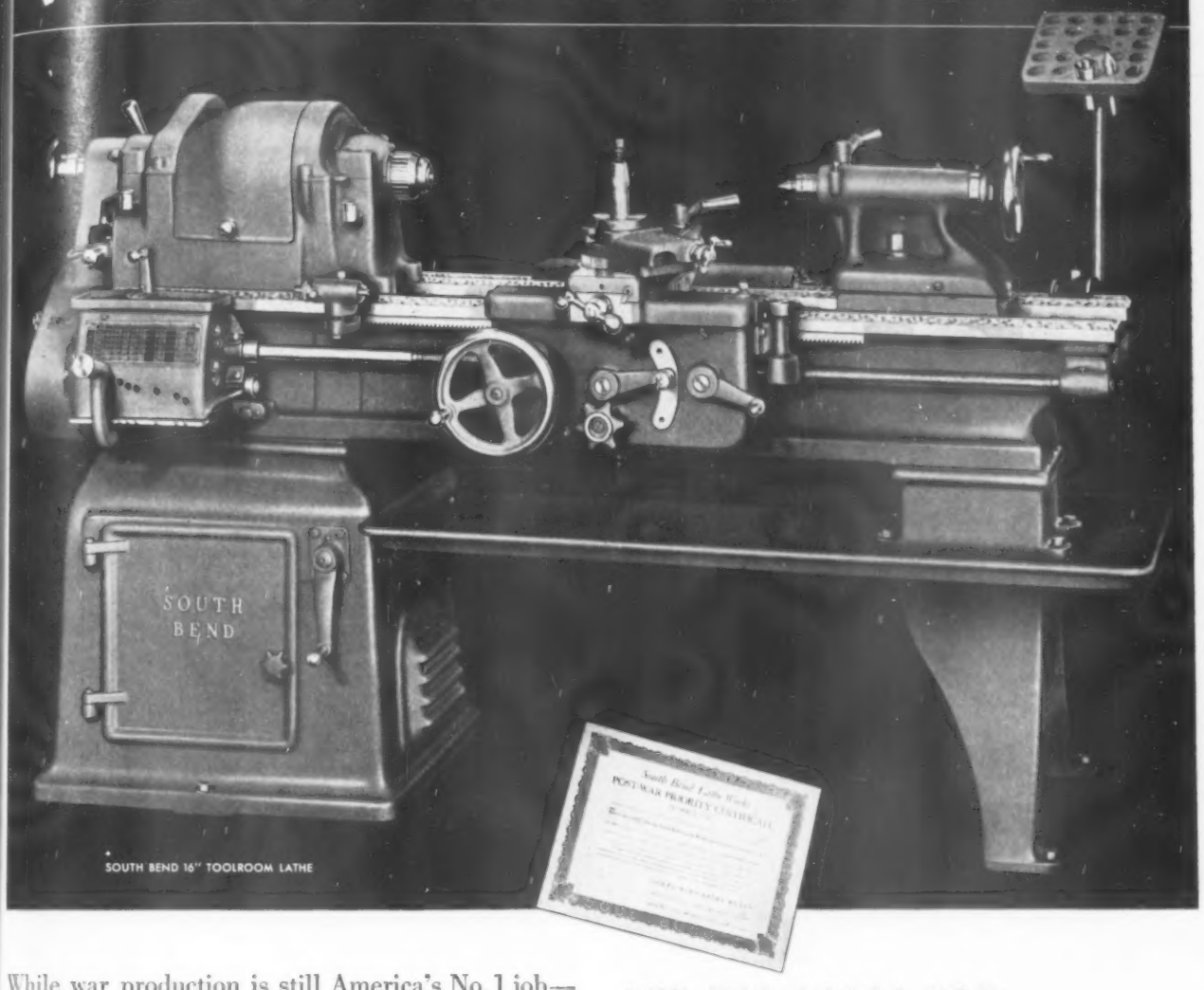
TIPPED TOOLS AVAILABLE IN SEVERAL STYLES (N82)

A new line of standard carbide-tipped cutting tools in six shank and tip styles has been announced by New England Carbide Tool Co., Inc.

The tips are finish ground on diamond wheels so that all exposed surfaces have a mirror finish for finer work finish. Available in two grades, the tools have a black, rust-proof finish with the name and tool style appearing in white on the side. The "U" grade,

(Continued on page 180)

Plan Now FOR POST-WAR PRODUCTION



SOUTH BEND 16" TOOLROOM LATHE

While war production is still America's No. 1 job—the time to look ahead to the greatest era of peace-time production is now. Placing orders immediately for post-war machine tools is the first step in reconverting to peace-time production. It means earlier delivery which will permit quicker reconversion—a very important competitive factor.

To manufacturing plants, large and small, where future-planning includes new lathe equipment, South Bend Lathe Works offers a practical post-war priority plan.

You can place your order now for any South Bend Lathe. No deposit or down payment is required. We ask only that your order be placed in good faith. Each order that is received will be acknowledged by a numbered Post-war Priority Certificate.

BUY WAR BONDS NOW...

SAVE FOR LATHES

When civilian production is resumed, lathe orders will be filled in the order established by the certificate numbers. Today's prices will apply unless conditions beyond our control necessitate changes. The order may be cancelled at any time. All South Bend Engine Lathes, Toolroom Lathes, and Turret Lathes, embodying improvements developed to meet exacting war production requirements, will be available. No revolutionary changes in design are contemplated.

Don't delay investigating this effective plan that will help strengthen your post-war position. Write now for full details of our Post-war Priority Plan and a copy of Catalog 100-C.

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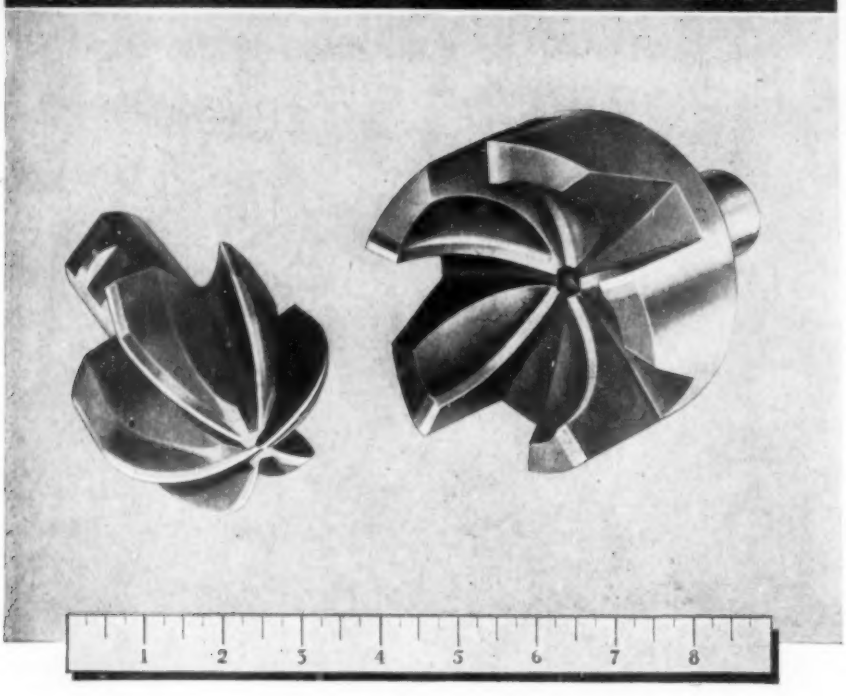
LATHE BUILDERS FOR 37 YEARS — SOUTH BEND 22, INDIANA

YESTERDAY'S PIONEER • • • TODAY'S LEADER



Special WELDON Cutting Tools for Creating Ball and Socket

THIS pair of WELDON cutting tools, specially made to close limits for the purpose of creating ball and socket, accurately turns out a job that ordinarily is considered quite difficult.

It is only one of many thousands of special tools made to order by WELDON which indicates the type of work WELDON is fully equipped to do.

If you have a special cutting tool problem our experience and skill in this field are at your service.

We can make immediate shipment of most sizes of WELDON End Mills. **Write for Stock List.**

THE WELDON TOOL CO. *Cleveland 4, Ohio*

3000 WOODHILL ROAD

INFORMATION FREE

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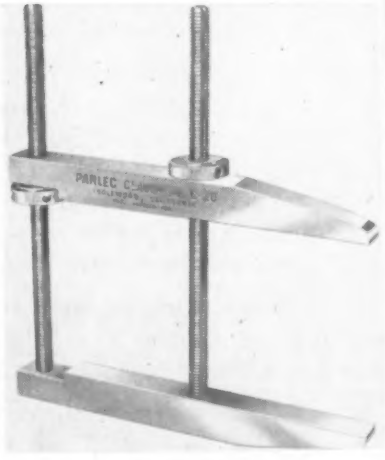
Carbide-Tipped Tools

identified by a red tip on the tool shank, will cut all materials except steel. The "S" grade is supplied for cutting steel and is identified by a blue tip on the shank.

CLAMP HOLDS SMALL WORK (N83)

Earl C. Parkhurst announces a new clamp for holding small work together in tapping, drilling, and similar operations.

The clamp consists of two case hardened steel jaws, two case hardened steel adjustment nuts and two heat treated steel studs. The moveable top jaw is controlled by two adjustments nuts, the front acting as a pivot and the rear one exerting the gripping pressure. A quick turn of the rear nut releases pressure instantly. Jaws are tapered on the end to allow clamping under a shoulder or recess. The lower jaw has no obstructions and fits close to the part held. The clamp may be used as a base when drilling of the part is necessary.



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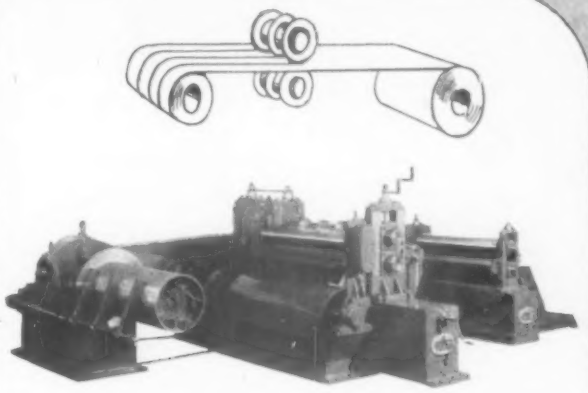
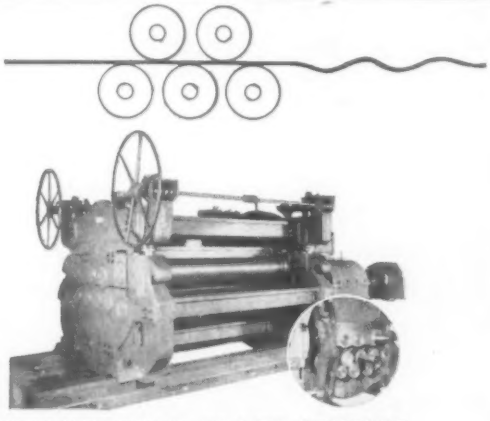


SLITTING LINE



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COMPLETE TUBE MILL LINE

MEET THE NEW PROBLEMS *with* YODER

Problems! Problems! Problems! Problems!

When it is a high-production metal working machinery problem . . . call on Yoder's engineering and manufacturing facilities.

Practical plans for solving such problems can best be formulated when specialized experience is brought to bear upon them. Rely on Yoder's thirty years of experience to create a machine with a *plan of action* built into it that will help you to meet the new conditions.

We have a general bulletin that presents a large variety of our *regular* line of machines. However, if yours is a special problem, send us rough notes and sketches. You'll be pleasantly surprised at our response.

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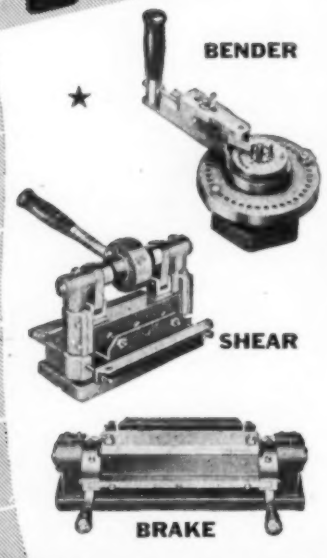

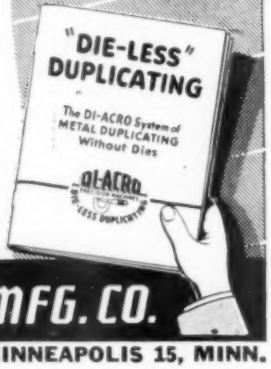

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GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

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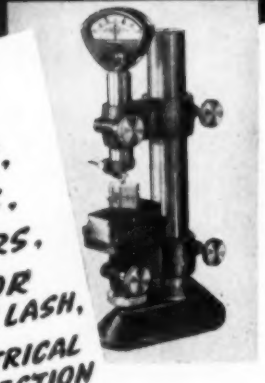

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MADE especially to lubricate dead centers of lathes. Provides effective protection against overheating, softening and scoring. Increases production and promotes accuracy by permitting heavier cuts, higher speeds and tighter set-up.

Use it also for steady rests, jack screws and other applications where a lubricant of extreme film strength is required.

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Their "know-how" . . . their special knack . . . is only gained from long years of accumulated experience. And they are still continually striving to improve what they make. Their knowledge and advice are at your service for the asking.

A LEADING AIRCRAFT manufacturer, with their cutting-off machines just coming into production, wrote us for recommendations for cutting specific metals . . . what saw . . . what speed . . . which machine. No chart supplied the answer. Our engineers went through that plant and developed complete cutting data . . . a special prescription for that particular case. And it did the job . . . 100%.

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TOOL HOLDER

This new, patented diamond tool holder provides a fast, accurate method of meeting every requirement in dressing and truing operations. Equipped with internal coolant ducts for wet grinding, and external cooling fins for dry grinding, metal setting as well as stone are kept at safe operating temperatures, eliminating diamond breakage, due to overheating. Thus, tool life is increased, resulting in savings from 30 to 50% in diamond dressing and truing costs. For finish-dressing SMITITE Diamond Tools are available, in which the stones may be completely consumed without resetting. *Catalog on request.*

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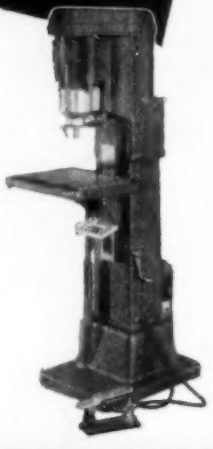
AIR CONTROL is the Secret of precision tapping The Haskins Way

Accuracy—to a class 4 fit when necessary—is constant—each part is tapped exactly like every other, independent of operator efficiency. AIR regulates the complete tapping cycle—not only the down stroke, but its control is so sensitive that the tap is allowed, in effect, to float out of the part. Tap life is longer—tap breakage practically eliminated. Send today for your copy of catalog on Tapping—The Haskins Way. R. G. Haskins Co., 2756 W. Flournoy St., Chicago, Illinois.



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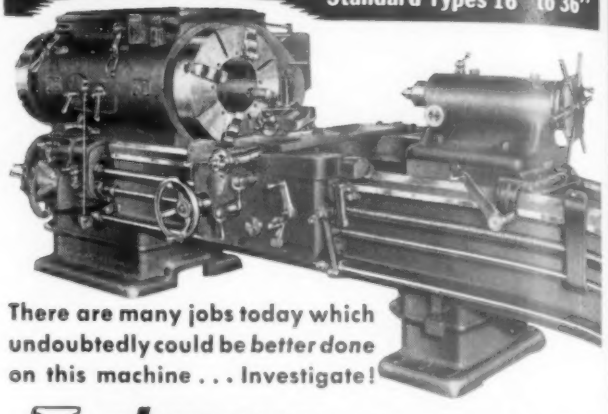
Increase Production, Improve Work, Save Man-Power and Materials!

FIVE SIZES—18" to 36"

Standard Types 16" to 36"



There are many jobs today which undoubtedly could be *better done* on this machine . . . Investigate!

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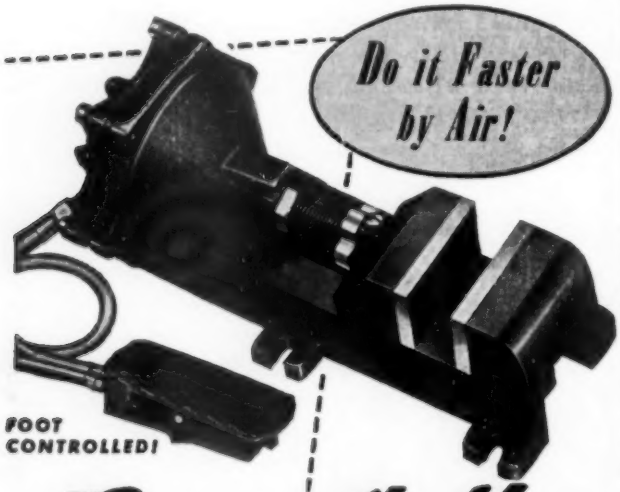

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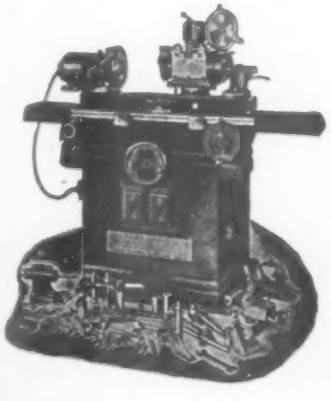
UNIVERSAL CUTTER AND TOOL GRINDER



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INVESTIGATE Tannewitz DI-SAWS

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A broad statement? Yes. But soundly founded on facts—the experience of numerous large manufacturers — the actual performance records of the machines, themselves — and fundamental superiorities of design and construction.

Larger wheels (24" diameter on the standard models) provide greater traction, faster, straighter cutting, more production. Transmissions, common source of die saw grief, never fail in TANNEWITZ DI-SAWS.

STANDARD MODEL No. M24
(24" WHEELS)

Sturdier, heavier construction throughout, plus many refinements of design, make these machines the greatest, trouble-free producers in their field. It pays to buy the best!

With a TANNEWITZ DI-SAW you can do in minutes jobs which require hours by the shaper, miller or lathe methods.

Get the complete facts. Just write for DI-SAW bulletin.

Other Models to Handle Work of Practically Any Size

Made with 30", 36", 48" and even larger throat capacities if desired, the TANNEWITZ "Big Bertha" models make available the tremendous savings of inside and outside sawing, filing and polishing on dies, jigs and other work of practically any size. Write for bulletin.

On request: Bulletins on Single and Variable Speed Foundry Band Saws; Sheet Metal Cutting Band Saws.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

NEW LITERATURE

T. M. REG. BY THE BRAMSON PUBLISHING COMPANY

OF INTEREST TO PRODUCTION EXECUTIVES

(1016) List of American Standards

Published by the American Standards Association, this catalog lists prices of Standards covered by the Association. It covers the fields of civil engineering and construction, mechanical engineering, electrical engineering, automotive, transportation, ferrous materials and metallurgy, non-ferrous materials and metallurgy, the rubber, chemical, textile, mining, wood, pulp and paper industries, miscellaneous, and commercial standards. In addition it lists American safety standards and American war standards.

(1017) Welding Applications

The Hobart Bros. Co. has available a series of loose leaf data sheets from its publication "Practical Design for Arc Welding". The data sheets cover specific welding designs in various fields of industry, and show practical designs for arc welding of many industrial products. They are easily read and understood, and illustrate applications by means of schematic sketches.

(1018) Steel

The Jessop Steel Co. has published a new bulletin describing its "J" & "JJ" Hot Work Steels. It lists analysis, applications, and working data for both types in detail.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

(1019) Sheet Metal Equipment

A new catalog describing their spray booths, metal parts washers, ovens, dust collectors, and other sheet metal equipment has been issued by Newcomb-Detroit Co. The catalog is illustrated and includes cut-away drawings of equipment mechanism, specifications, and size and capacity charts. In addition it also contains a 36-page engineering data section containing useful information for engineers working with sheet metal.

(1020) Metal Joining

Callite Tungsten Corp. has available two new bulletins designated as **No. 154** and **No. 155.** No. 154 deals with the company's electrodes for atomic hydrogen, helium, and argon arc welding. In addition to describing and illustrating the electrodes it contains practical welding applications.

Bulletin No. 155 deals with Callilflex bi-metal, which is described as a reliable economical material for use as a temperature responsive element in automatic control. It gives technical data on the deflection and power of the various types in strip and coil, data on thicknesses, sizes and similar information of value to the product designer and engineer.

(1021) Metal Finishing Machinery

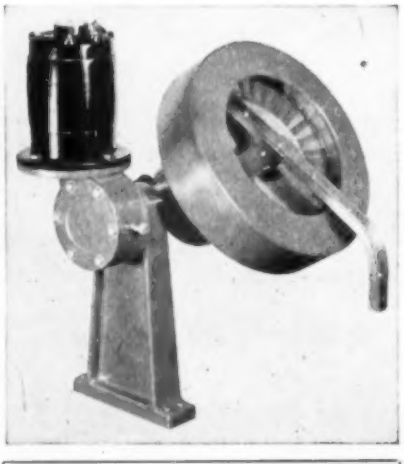
A new 20-page catalog, illustrating a complete line of grinders and buffers has been issued by the Queen City Machine Tool Co. It illustrates and describes the company's representative models of bench, heavy-duty box type, and pedestal grinders; combination buffers and grinders; heavy-duty buffers, and disc grinders.

(1022) Cutting Tools

Crucible Steel Co. of America has available a new catalog designed to give metal working men essential facts and figures on Rexalloy to help them select the most efficient tools for middle-range machining applications be-

(Continued on page 188)

HOPPERS and SCREWDRIVERS



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ADAPTABLE TO ANY MACHINE!

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HOPPER FEEDS: Bullet Cores, Rings, Pins, Rivets, Nuts, Screws, Discs, and Special Parts.

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REDUCE COSTS INCREASE PRODUCTION

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THREE MODELS

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No. 2 to 3/8 Screws

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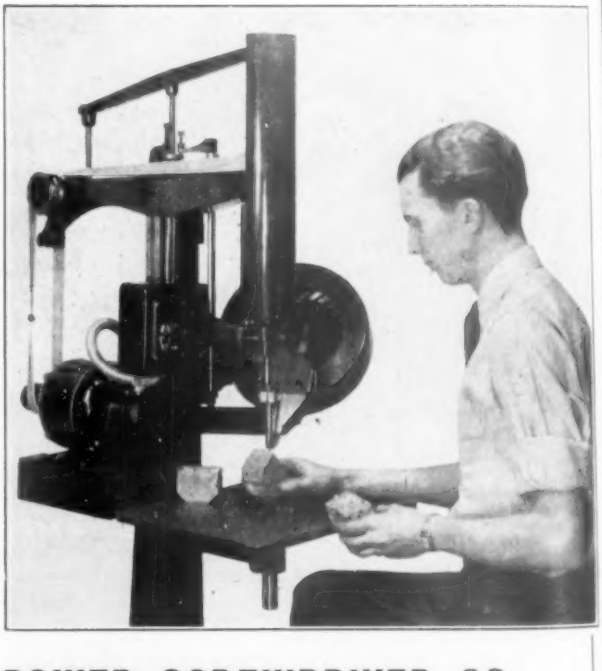
Send Samples For Production Estimates



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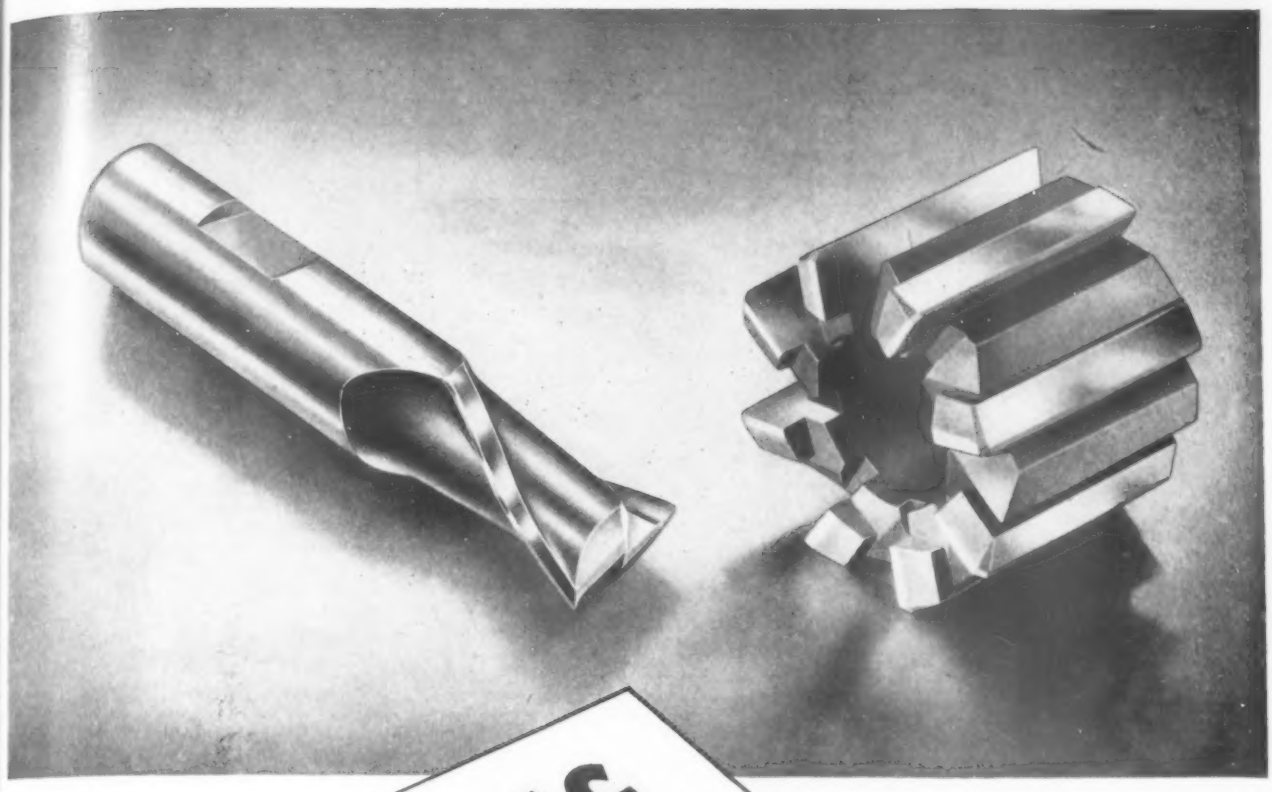

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Solid End Mills and Shell End Mills with brazed-in Tantung blades are establishing production records, all over the country. Many jobs that were slow and expensive when high-speed steel cutters were used are now being milled faster and cheaper with TANTUNG. Use Tantung cutters when you cannot use Carbide.

SOLID End Mills

Are made in two and four flutes and are furnished both for steel cutting and non-ferrous metal cutting.

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Tantung is fully covered, graphed and illustrated in the Tantung Tool Catalog. Write for your copy today.

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These cutters are made of a tough alloy steel body, with brazed Tantung blades. Designed to fit standard arbor equipment.

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tween the upper limits of high speed steel and the lower limits of tungsten carbide tools. The publication contains facts about Rexalloy, range of speeds and feeds, tool tips, and other information about the alloy.

(1023) Cutting Oils

D. A. Stuart Oil Co. has available a 20 page booklet entitled "Soluble Cutting Oil at Its Best."The publication is devoted to discussion of difficult problems involved in the selection and application of water-mix oils. It deals with constituents and uses of good soluble oil and antiseptics found in oils, and tells how to mix soluble oils for best results. It is well illustrated with photographs of machining operations and laboratory tests.

(1024) Machining

The Machine Products Corporation has issued a new catalog listing its complete line of products. The book illustrates and describes the company's surface plates, angles, parallels, vee blocks, straight edges, cylinder squares, knobs, wheels, levers, and rotable face plates.

(1025) Inspection

Continental Machines, Inc., has issued a 64-page handbook entitled **"Quality Control,"** dealing with the entire scope of precision measurement.

Explanation of scientific inspection is bolstered by lavish use of photographs, diagrams, charts, and tables. One section discusses 24 subjects vital to precision measuring and explains the use of many precision instruments such as the sine bar, vernier gage, optical flats, and similar instruments. These measuring devices are pictured, showing their use in establishing quality control throughout the entire production setup. It contains many tables and considerable data pertaining to gaging methods used in precision measurements.

The company also offers a group of films, charts, and illustrated booklets as further training aids on scientific inspection.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

(1026) Steel Tubing

The Bissett Steel Co. has issued a four-page folder entitled **"How Tool Steel Tubing Will Save You Time, Money, Manpower and Metal".** It describes the use of steel tubing for blanking dies, forming dies, punches, collets, collet closers, spindle thrust collars, and many other tools and parts.

(1027) Forming

A new folder entitled **"Roll Forming Machines"** has been made available by the Yoder Company. It outlines features of the company's roll-forming machines and illustrates suitable accessories. It also includes a brief list of specifications and capacities.

(1028) Cutting Tools

The Weldon Tool Co. has issued a new catalog, designated as No. 8-B, illustrating and describing its line of cutting tools. It also contains a section on special tools and useful information for engineers.

(1029) Diamond Wheels

Larco Diamond Tools has issued a compendium containing questions and answers on diamond impregnated grinding wheels. The 32-page book deals with recommended uses, economical operations, proper maintenance, and similar questions.

(1030) Molding

Detroit Mold Engineering Co. has available two publications dealing with its standard mold bases. Its 21-page catalog contains drawings, dimensions, specifications and other descriptive material on the company's standard line of mold bases. Also available is a monthly publication entitled "DME News", devoted to the standardization of plastic molds.

(1031) Tapping Equipment

Cleveland Tapping Machine Co. has issued two bulletins dealing with its Model D and Model DB lead screw controlled tapping machines. The folders illustrate and describe features and specifications of the machines.

(Continued on page 190)

HIGH SPEED END MILLS
★
CONTINUOUS PILOT COUNTERBORES
★
SPIRAL FLUTED CHUCKING REAMERS
IMMEDIATE DELIVERY
From This Stock On All 761 Items In The Putnam Line
This photograph shows one part of the Putnam Tool Company stock room in which are maintained complete stocks of Putnam Hi-Speed End Mills, Continuous Pilot Counterbores and Spiral Fluted Chucking Reamers. Putnam dealers also carry complete stocks of Putnam tools available for immediate delivery. In any part of the country, delivery can be made within 48 hours after the order is received.
If you are not familiar with the complete line of Putnam tools, write for a catalog today . . . or call the nearest Putnam representative.
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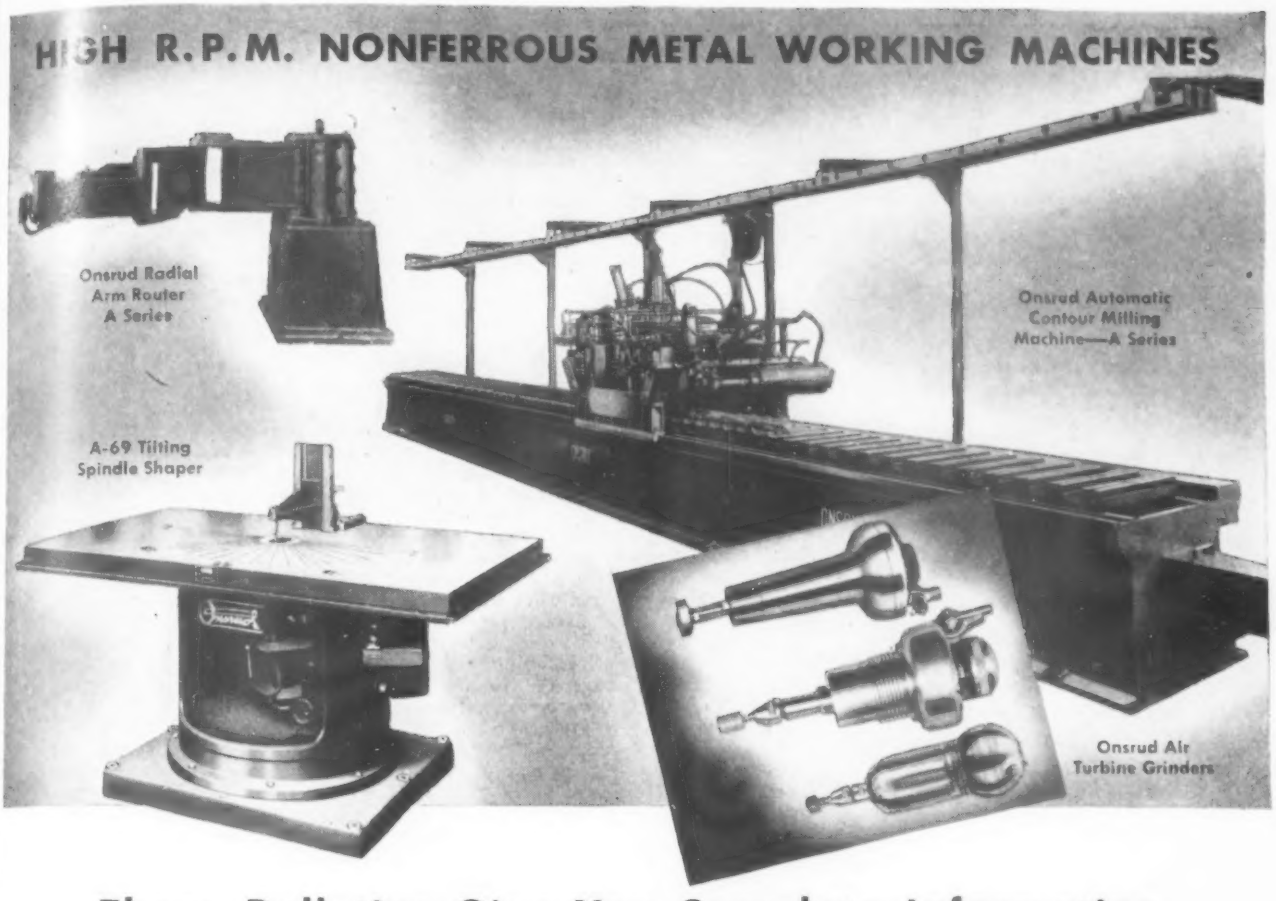
ARMY E NAVY
PUTNAM TOOL COMPANY
2987 Charlevoix Avenue • Detroit 7, Michigan

HIGH R.P.M. NONFERROUS METAL WORKING MACHINES


Onsrud Radial Arm Router A Series
Onsrud Automatic Contour Milling Machine—A Series
A-69 Tilting Spindle Shaper
Onsrud Air Turbine Grinders

These Bulletins Give You Complete Information

If you've been wanting complete information on the high speed machines that the metalworking publications have been writing about recently, take advantage of this Onsrud offer. Write for the machine bulletins described below. Some of these machines, of course, were designed specifically for aluminum alloy aircraft parts production. But the principles involved in machine design apply in all industries — wherever the light metals must be machined. It may prove of considerable advantage to you to have this data now.

MILLING

This gives the facts about Onsrud Automatic Contour Milling Machines. Extruded wing spars, some as long as 50 feet, are milled in a matter of minutes. Four cutter motor assemblies on a traveling carriage make numerous types of milling cuts—face, slot, twist and taper, as well as cut-outs.

ROUTING

How would you plan the job of cutting out to exact size and shape a production run of parts from flat sheet stock? Large Onsrud Radial Arm Routers cut or rout work from single nonferrous flat sheets up to 4′ x 12′ in size. Router bits are direct high cycle motor driven at 15,000 RPM. Machines like these, with drill heads, perform drilling operations under a similar procedure.

SHAPING

Actually a type of milling machine, the cutter of the Onsrud A-69 Shaper may be set at any off-vertical angle up to 20° toward either the front or back of the machine. Used for beveling as well as trimming channels and similar parts. Cutters turn at 10,800 RPM.

GRINDING

Onsrud air turbine Grinders have spindle speeds ranging from 38,000 to 75,000 RPM. These are successfully used on all types of materials. The wide range of high speeds provides the proper speed for even grinding wheels below ¼" diameter. Units like this are machine mounted for such operations as precision die grinding.

Write for bulletins today. Manufacturers with present or contemplated production problems involving the machining of nonferrous metal alloys or related materials are invited to write to Onsrud for information and assistance now.

ONSRUD MACHINE WORKS, INC.
3927 Palmer Street, Chicago 47, Illinois
Sales Offices in All Principal Cities

MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION

(1032) Die Heads

Murchey Machine & Tool Co. has available three booklets dealing with its types "CO", "G", "A", and "C" self-opening die heads. The bulletins explain fully the construction of the heads and explain by illustrations and examples how to use and maintain the die head. They also contain principal dimensions, assembly instructions, disassembly instructions, information on changing chasers, and other operating data.

(1033) Special Purpose Machines

Blue Book for Management, Shop, and Production Engineers. Published by The Delta Mfg. Co., this publication presents case histories of 140 special-purpose machines built speedily and at considerable savings in first cost and fixed charges to expedite war production.

It explains designs which employ standard drill-press heads and columns and other low-cost tools made by the company and reports on production increases attained without use of costly special machines. The examples illustrated and described cover a wide variety of operations on metals, plastics, and wood.

(1034) Broach Push and Pull Heads

Published by American Broach & Machine Co., this 8-page bulletin describes, illustrates, and lists specifications for the company's four-jaw automatic broach pull heads, keyway broach pull head, round pin type pull head, key type pull head, threaded type broach puller, broach push head, and various types of broach shanks.

INFORMATION FREE

To receive the booklets listed in this section, list the key number found on the heading of the desired literature and your name and address on the postcard coupons—page 163.

NEW BOOKS

Work Methods Manual, John Wiley Sons, Inc. 136 pages. Price, $1.75.

In this book, the author Ralph M. Barnes, Professor of Industrial Engineering and Director of Personnel, College of Engineering, University of Iowa, undertakes to explain the fundamentals of good work methods. Although written principally for foremen and supervisors, it is slanted to workers as well.

The principle and techniques discussed in the book are the same as those used in training professional industrial engineers. Process charts, man and machine charts, and operation analysis are discussed fully, and considerable discussion is devoted to ten principles of motion economy which have wide application. Specific illustrations indicate how these may be applied and show what results may be expected from their use.

This book certainly cannot be called academic in its approach. Rather it is a simple down-to-earth treatise on fundamentals on work organization and motion economy. The author has done a singularly good job in his selection of illustrations and examples which are used abundantly throughout the book.

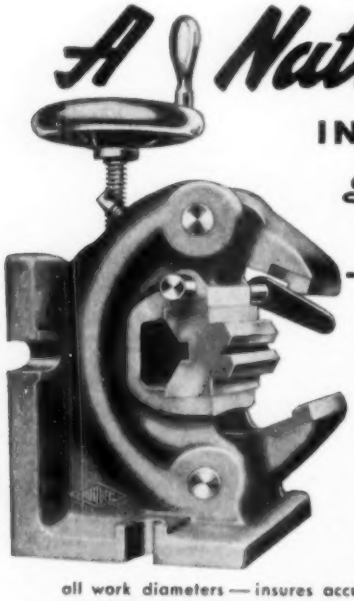
Treatise on Planers

The Cincinnati Planer Co. 134 pages. This publication thoroughly covers the complete field of planing, starting with the first crude planers made 200 years ago and extending up to present day modernized machines.

The book contains a great deal of practical information and suggestions on selection, care, maintenance and operation of the planer. It discusses tools for the planer, work setup, adjustable planer stops, cutting speeds, types of planers, examples of various types of work performed on the planer, and details of planer construction. It is well illustrated with both photographs and drawings. The publication also contains valuable suggestions on work holding devices, speeds and feeds, tool lifters, index heads, gages, and other accessory devices.

This book can be recommended to persons in metal-working industries who are interested in a comprehensive treatise on planing operations. Although it could hardly be called non-technical, it should be easily understood by any person with a modicum of experience or training in metal working.

THE END



A Natural...
IN ANY SHOP
Self Centering Shaft Vise

This modern machine vise is a "natural" because it just naturally is an asset to any machine shop. For machining slots and keyways in shafts or spindles, ⅜" to 3⅛" diameter—suitable for horizontal or vertical mounting. Setting of vise remains unaltered for all work diameters—insures accurate radial cuts. Hardened V jaw reversible in vise—equal movement of two jaws locates shafts correctly in V jaw.

Base size 8" x 7¼". Approx. wt. 80 lbs.

Write for circular.

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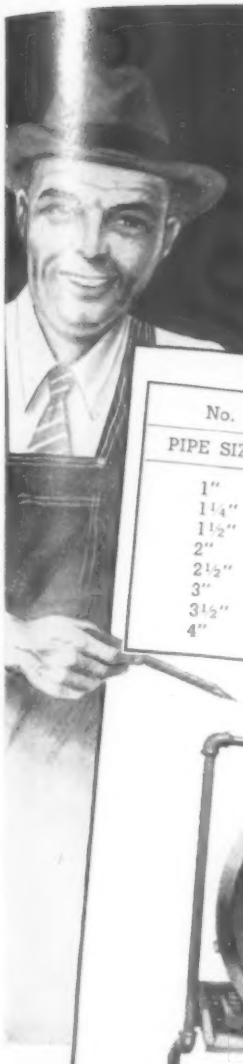
For your special cutting tool orders we have modern equipment, skilled workers and the "Know How" to insure accuracy and fine workmanship. At present we can offer attractive deliveries for all types of cutting tools.

Send your inquiries for special cutting tools to A. C. E. Bulletin on request.

AMERICAN CUTTER & ENGINEERING CORP., 31751 Mound Road, Warren, Mich.

AMERICAN CUTTER
AND ENGINEERING CORP., WARREN, MICH.
SPECIALIZING IN HIGH SPEED CUTTING TOOLS TO YOUR PRINTS

THE "SECRET" OF WILCO PIPE THREADING SPEEDS IS THIS "NO CHANGE" — Die-Head



No. 704 "WILCO"		No. 706 "WILCO"	
PIPE SIZE	SECONDS	PIPE SIZE	SECONDS
1"	16	1½"	19
1¼"	16	2"	20
1½"	24	2½"	30
2"	25	3"	31
2½"	38	3½"	48
3"	40	4"	49
3½"	56	5"	70
4"	58	6"	74

Note pipe threading speeds at left showing seconds required to cut full American National Standard Thread on the No. 704 and No. 706 Oster "WILCO" Pipe Threading Machines.

The "WILCO" die-head handles all sizes within range of each machine. *"Never a die-head change!"* One set of chasers threads all sizes American National or A. P. I. Standards of the same pitch, without change. Movement of cam lever sets chasers to any size. Extreme accuracy in setting chasers for any depth thread desired is easily obtained by movement of lever equipped with micrometer adjustment.

Complete details about these modern threading machines are given in illustrated catalog "LIST No. 10-A." Write for your copy.

Range of "WILCO" No. 704

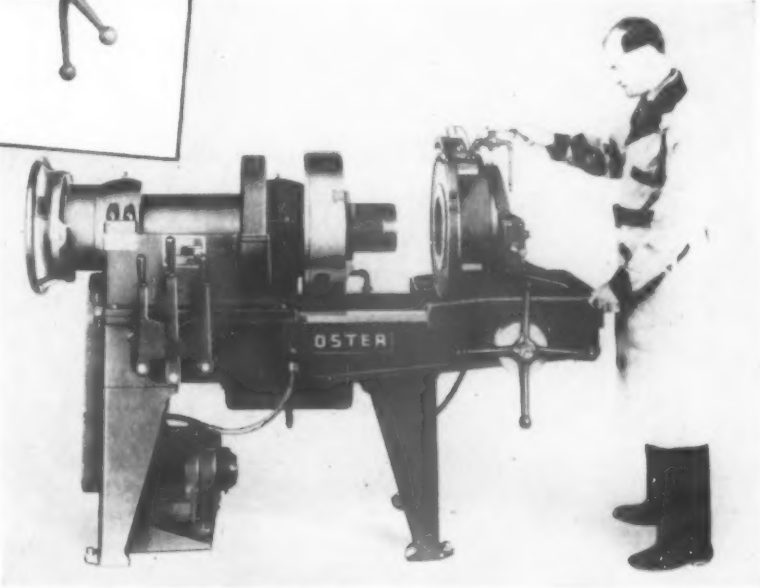
Regular range: 1" to 4" pipe
Extra range: ½" and ¾" pipe
Bolt range: ¾" to 1⅝"

Range of "WILCO" No. 706

Regular range: 1" to 6" pipe
Bolt range: 1" to 2"

REGULAR EQUIPMENT

Furnished with each "WILCO" machine: one complete set right hand, *high speed steel* pipe chasers with holders; cut-off device; cut-off tool; reaming and chamfering forming tool; oil pump and oil reservoir; three-jaw gripping chuck on front of spindle; four-jaw centering chuck on rear of spindle; motor of required standard specifications and non-reversing, magnetic controls.

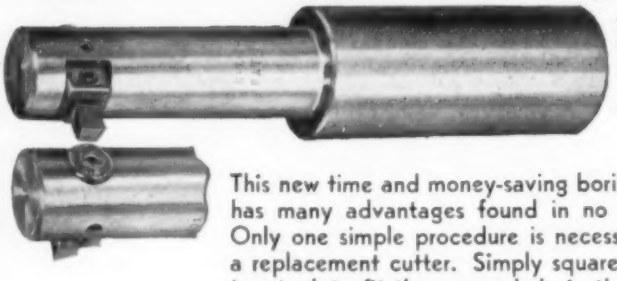


OSTER for faster, better threading

THE OSTER MANUFACTURING COMPANY, 2063 EAST 61st ST., CLEVELAND 3, OHIO, U. S. A.

NEW NASH-ZEMPEL BORING BAR INSERT

Micrometer-Adjustable



SHORT PIECES OF SCRAP TOOL BITS MAY BE USED AS REPLACEMENT CUTTERS

This new time and money-saving boring bar insert has many advantages found in no other insert. Only one simple procedure is necessary to make a replacement cutter. Simply square up the cutter stock to fit the square hole in the insert. No special tools necessary.

The insert can be installed on any bar available by a simple boring and milling operation. The locating head of the boring bar insert fits snugly into the recessed slot of the bar. The set screw in the boring bar locates the insert and draws the head firmly against the shoulder of the recessed slot in the bar. Accurate location point is always maintained.

Write at once for complete, descriptive bulletin

NASH-ZEMPEL TOOLS

Division of J. M. Nash Company

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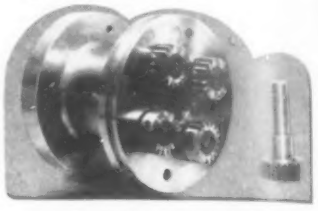
GARRISON GEAR CHUCKS

are used on:

Gear Shapers . . . Drill Presses . . . Engine Lathes . . . Turret Lathes . . . Internal Grinders . . . External Grinders . . . Gear Tooth Grinders . . . Oscillating Grinders . . . Diamond Boring Machines . . . Horizontal Boring Machines.

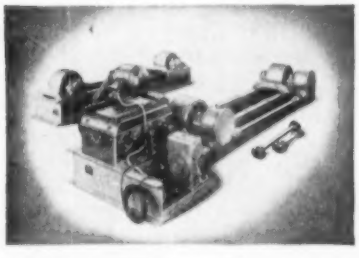


and are used for:

Grinding, Machining, Precision Boring and other operations on Spur, Internal, Bevel, Cluster, Helical and Herringbone Gears.

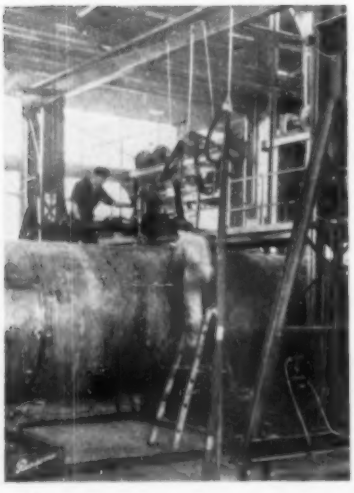
GARRISON MACHINE WORKS, Inc.

DAYTON 7, OHIO



TURNING ROLLS *and* AUTOMATIC WELDING

The Perfect Team . . . FOR BETTER AND FASTER TANK WELDING



The constant uniform speed of Ransome Turning Rolls makes them ideal for use with automatic welding heads when welding large circular tanks and cylinders.

The units are equipped with variable speed transmissions giving a wide speed range and means for changing the center-to-center distance of the rollers for handling work of various diameters. Smoother, better welds and more economical production result. Write for full information.

WELDING POSITIONERS

HEADSTOCKS-TAILSTOCKS • SPECIAL POSITIONING EQUIPMENT

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DUNELLEN, NEW JERSEY

SUBSIDIARY OF

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Let Us Recondition Your Tap Extractors

48 Hour Service

Send us your damaged tap extractors. All broken holders, collars, and sleeves will be replaced without charge. Steel fingers replaced at standard list prices. "Tools are Weapons—treat 'em right!"

Walton TAP EXTRACTORS Back Out Broken Taps

- ***No annealing**
- ***No drilling**
- ***No damaged threads**
- ***No costly delays**

Immediate Shipment. Stock sizes No. 4 to 1½", 2, 3, 4 flutes. 30 day free trial.

Write for folder No. 11.

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FREE Sample
TAMMS
LAYOUT DOPE
in Blue, Black, Orange and Red

Speeds layout time on brass, aluminum, copper, tin, stainless steel. Oil Resistant. Won't chip, crack or flake off. Also ideal as a marking dye for easy identification of metals. Comes in handy 8 oz. dauber type brush-in cans. Also pts., qts., gals.

TAMMS SILICA CO.
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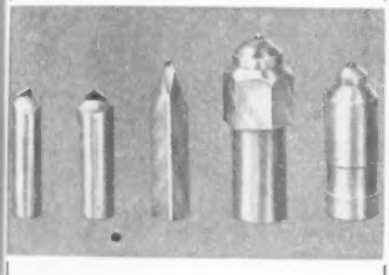
ADAMANT HAS A WINNER
IN ITS
Diamond Wheel Dressing Tools



The new type of setting used in Adamant Diamond tools will give you more economy, because this setting eliminates the problem of lost or loose diamonds. The entire diamond may be consumed without resetting. 20 years of engineering experience behind each tool.

Order one tool now for trial in your plant. We will refund your money if you are not 100% satisfied with its performance. Adamant uniquely set highest quality tools will bring you a big saving over your present diamond tool costs. DELIVERY IN ONE WEEK TO ANY PLACE IN THE COUNTRY. Inquiries invited. Send blueprints, specifications of your requirements, etc. We have a winner!

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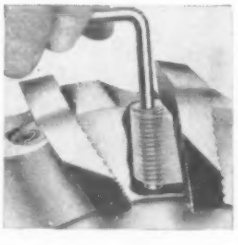
FACTORY AT BLOOMFIELD, NEW JERSEY
Midwest Sales Office
209 SOUTH STATE STREET, CHICAGO, ILL.
Phone HARrison 8173

FINER ADJUSTMENT
LONGER BLADE LIFE
GREATER RIGIDITY

McCROSKY'S JACK-LOCK WEDGE, occupying a semi-circular recess in the cutter body, forms an independent unit with its fine-pitch setscrew. Tightening of the setscrew lifts the wedge **like a jack,** putting blade serrations into rigid engagement with body serrations. This locks the blades securely, assures rigidity.



McCROSKY'S ADJUSTING SETSCREW behind each blade provides fine, accurately controlled forward adjustment. This holds the amount of blade stock removed in resharpening to a minimum. The individual-adjustment feature permits independent reclaim of blades without sacrificing the life of other blades in a set.

Write for Bulletin 16-M, containing full information on sizes and types of Jack-Lock Milling Cutters, and McCrosky Milling Cutter Manual on use and care of Jack-Lock Milling Cutters.

McCROSKY TOOL CORPORATION, MEADVILLE, PA.

HANDY ANDY *Says*—

T. M. REG. BY THE BRAMSON PUBLISHING COMPANY

WHILE the Philadelphia convention is history, an informal account of in-between activities may provide diversion for attendees and stay-at-homes alike. At that, I can only hit the high spots.

To begin with, the Detroiters came down in force to see their favorite (adopted) son, Al Sargent, installed as 2nd. vice-prex. Not that there's anything provincial about Al; born in New Hampshire, and with interests spanning the continent, he is an outstanding engineer and business man, the benefit of whose election will accrue to the Society. So, for that matter, will the election of Canada's Len Singer as ass't. sec'y-treasurer.

▲ ▲ ▲

Next, there will quite logically be consideration of regional vice-presidents, of which the post of 3rd. v. p., now held by Pennsy's Brad Peirce, may be a forerunner. In all, we now have a nicely balanced Exec. Com'tee that should be welded the stronger during Doug Burnside's tenure. We enter our teens with confidence in the future.

Shortly before the Convention, I had a letter from John Sundkvist, of Hartford, intimating that he was going to make me a "big shot" in Philly. Now what? When we met, he presented me with a fine old English flintlock pistol, and, soon's I can get me some black powder I'm going to make good. But not in Philly.

▲ ▲ ▲

Monday, along with George Highberg, Hank Rockwell and Harry Hauck, John and I visited the Swedish Museum. We found especial interest in the John Ericsson Room, devoted to the various inventions of the creator of the Monitor.

That evening, the five of us were guests of Wm. Jarvis, of The Chas. L. Jarvis Co., at a steak dinner. Steak! Included in the group were Rudy Wetzel and Martin Buehler, Jarvis representatives, and Ed Murphy of East Orange and his winsome colleen. I gathered, however, that Mrs. M. was more versed in Swiss yodels than in Irish comeallyes.

It turned out that Ed is neighbor of Dr. Lawson, prex of my alma mater, Upsala College, while Harry Hauck is an alumnus of Battin High in Elizabeth, agin whose star pitcher I once swung a bat—and missed. It was, me, a pleasant and long-to-be-remembered occasion. Thanks a lot!

▲ ▲ ▲

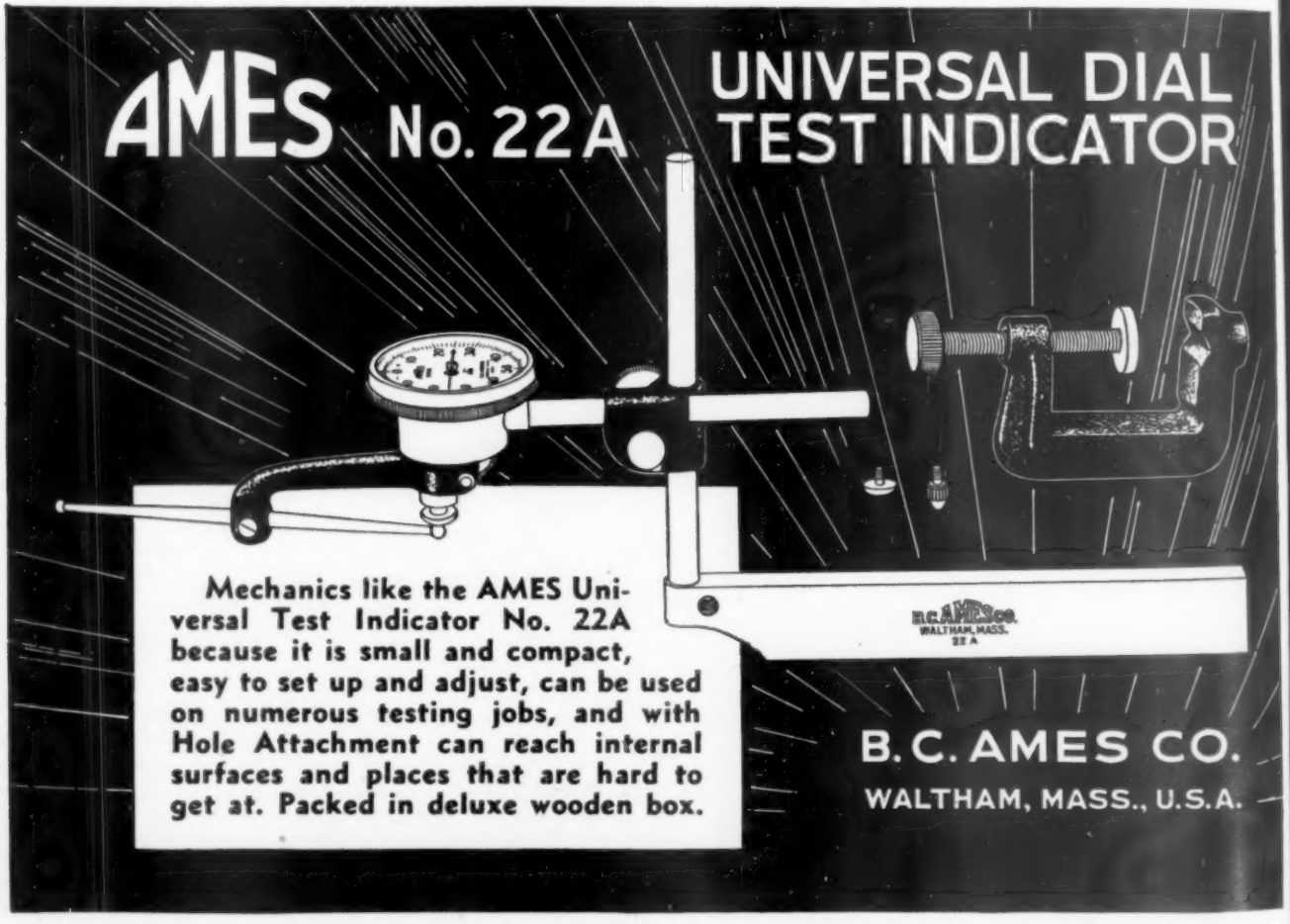
Through John, I met various other attendees from the Connecticut Valley; Dick Smith, Charley Mosher, Joe Balciunas and Hans Nelson, also, a Charley Lowe whom my scrambled notes somehow don't place along the way stations. And, J. H. Goeteman, ass't. sales mgr. of Bethlehem Steel.

Later, had a hello with past prex d'Arcambal, looking fit as ever. And, of course, Ray Morris, no doubt glad to relinquish the reins after a strenuous and successful year.

From Providence, met Ed Berry, Nomas Reed and Jack Seifert. (Wonder if he's a son of an old pal from N. Y.?) From Boston, G. W. Exley and gadgeteer Walter Pohle; from Worcester, Bob Lippard, every hair in place, John Lindegren, ditto but with fewer, Vic Ericson and Tom Bradford. And from Northern New Jersey, ex-ditto Bill Brown.

From Syracuse-Rochester, Steve Urban and Al Mitchel, with whom I enjoyed a lively chat; Milt Roessel, whom I didn't place until he removed his hat; Bob Barnett, with good ideas about tool engineers; Chauncey New-

(Concluded on page 196)


AMES No. 22A
UNIVERSAL DIAL TEST INDICATOR
B.C.AMES CO. WALTHAM, MASS.
22 A
Mechanics like the AMES Universal Test Indicator No. 22A because it is small and compact, easy to set up and adjust, can be used on numerous testing jobs, and with Hole Attachment can reach internal surfaces and places that are hard to get at. Packed in deluxe wooden box.
B. C. AMES CO.
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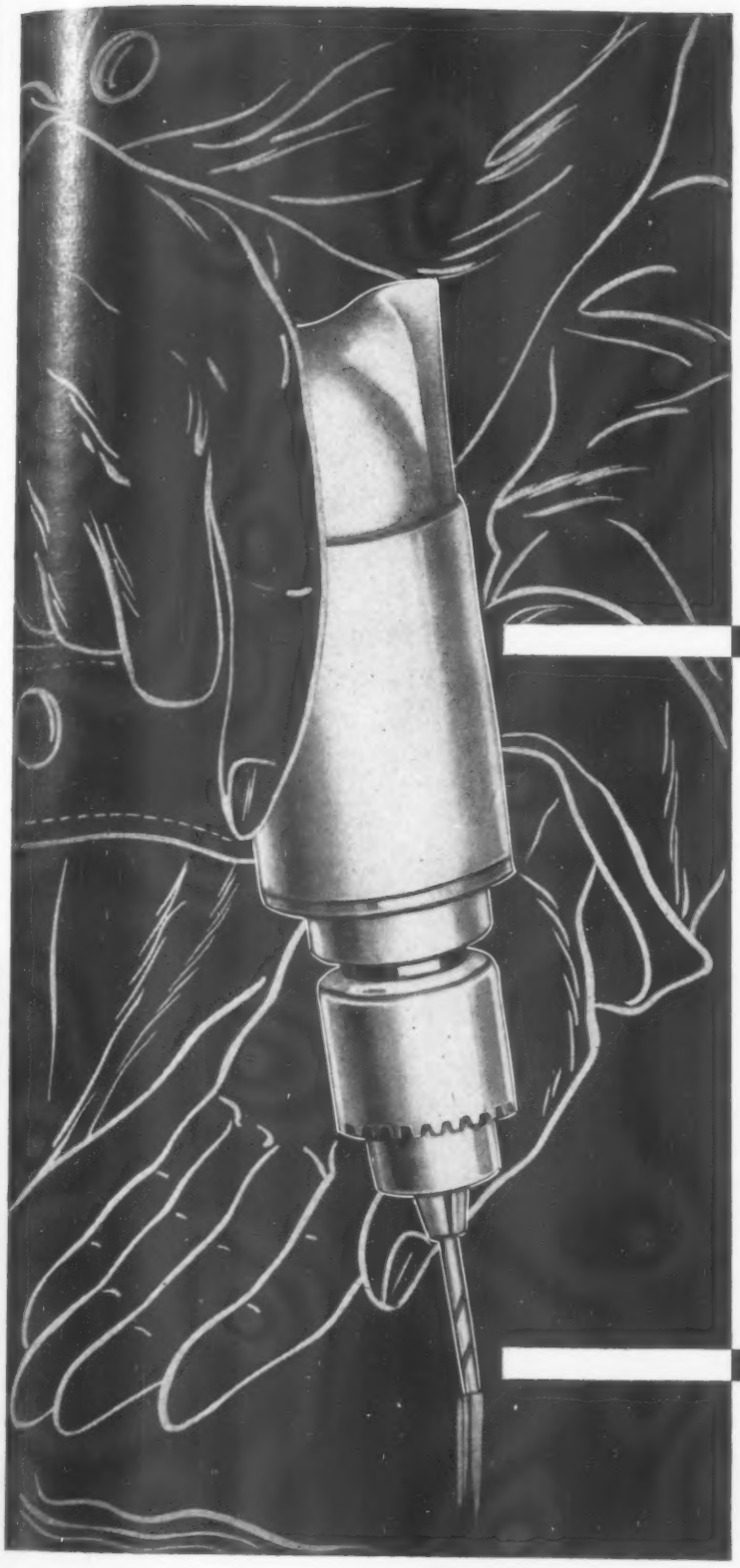

CP-301

Light-weight, Pneumatic Production Drill

Ideal for Women

Designed especially for the aviation field . . . amply powered for fast 1/8" to 3/16" drilling in light metals . . . these light, compact CP 301 Pneumatic Drills are ideal for women. Available in a wide range of sizes and speeds, with angle heads, handles and throttle types to meet every drilling condition. Speeds 2800 to 15,000 r.p.m. Overall lengths (depending upon type of handle) from 6¼ to 8⅞"; weights, from 1⅝ to 2⅜ pounds. Write for further details.

CP 301 is only one of a wide range of CP Pneumatic Drills, Reamers, Tappers, Screw Drivers, Nut Runners, Wood Borers, etc. Write for a copy of Catalog 564.

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PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

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AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

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Mean Bigger Profits

SPEED CASE STEEL

A LOW CARBON OPEN HEARTH PRODUCT

ELIMINATES OPERATIONS

• Smooth Finished Parts
• Minimum Machine Run-Out

If you wrote your own specifications for *the ideal*, all purpose, open hearth carburizing STEEL, it would be . . .

SPEED CASE!

BUY
WAR
BONDS

Operation Eliminated!

These unusual parts were produced on a 6" Automatic with such a fine finish that customer was able to eliminate a subsequent grinding operation formerly necessary when he used SAE X1314. Also, there was no measurable "Run-Out" or Warpage, a condition formerly causing large rejections. Estimated Savings per ton of Steel used, $69.43.

Write for SPEED CASE CATALOG. Actual shop records showing savings of 20 to 65%.

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THE FITZSIMONS COMPANY
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HAMMOND • INDIANAPOLIS • CHICAGO
PECKOVER'S LTD. Toronto, Canadian Distributor

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

—HANDY ANDY SAYS—

(Concluded from page 194)

ton, whose hospitality I sampled, Joe Schick and Fay (?) Decker.

Canada, too, was well represented, Bob Douglas and Walt Appleton, of Montreal, and A. J. Napier of Vancouver, spanning the Dominion.

Fred Schytte from Toronto, the Duke but a shadow of his former self; Phil Harrison of Windsor; Eric Crawford of "Canadian Machinery" from Hamilton, popular Bill Dawson; Tom Fechnay, new ch'man; Harry Coit, who bolstered my morale when I spoke there; Ed Greer, Gord Hall, Dave Grieg, Charley Fisher and Jack Walton, all come to sing "The Maple Leaf Forever" to the tune of "God Save the King".

▲ ▲ ▲

From Chi, Rudy Miller, new ch'man; King Cole with his silver crown; Bill Reiff of Cleveland, who won the '45 Convention for the Forest City; Jim Knight, Ed Bertschi, E. F. Bain—and, of course, Dir. Carl Holmer from Peoria. Charley Paige and Eldon Wishart from Maine, and Harry Loebel of Baltimore.

Lone wolves (as far as I could see), Gardner Young of Pittsburgh, and from somewhere—Washington or Walla Walla (I can't tell which), a genial guy by name Stan Birleson. A glimpse of Frank Martindell, a "how-do" with Bill Gamble; compared notes on old guns with Hallet Jones; repartee across the lunch table with Paul Frankfurter, Ed Dickett and Frank Curtis.

▲ ▲ ▲

Toastmaster Bert Carpenter, with his charming inspiration; Ot Winter of the U. S. A., and Mrs. W., Red Cole, Steelman W. C. Frederick, and Horace Wentzell, all with their life partners; a glimpse of Mr. and Mrs. Roy Bramson, with Mrs. Adrian Potter and vivacious Mrs. Douglas Burnside. Beginning to read like a society column!

Saw altogether too little of our Philadelphia hosts, albeit plenty of the City of Brotherly Love, as aching dogs attested. I rambled up and down, all around the town—broke no china.

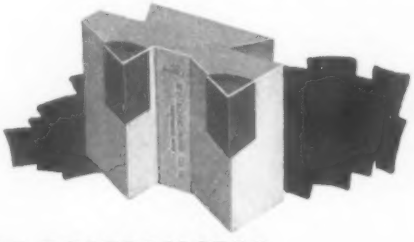
▲ ▲ ▲

Met Tom Donovan, Foster Crayton, and Frank Jennings (got a note there—"handsome"—but can't tell which) and had a glimpse of Jack McMonagle on the go. Saw plenty of the extrovert Connie Hersam, who registered woe a/c a plant had let him down but who is to be highly complimented for his fine handling of plant tours. You're okay, Connie!

At the banquet, sat next to Jos. Barnes, prex of the Phila. Engrs. Club, and a swell guy to boot. At the banquet, too, saw some 1250 people more or less, so if I've missed a lot of their names (wouldn't you?) they were all there, most listening to the program and some (unofficially) taking part in it. Anyway, it was a big wind-up to an interesting Annual. And now, s'long everybody 'til we meet in Syracuse.

THE END

COMPLICATED?



CLOSE TOLERANCES?

UNUSUAL?

SPECIAL?

SPECIFY

NEW ENGLAND *Carbide tipped* FORM TOOLS

GET WHAT YOU ASK FOR—EXACTLY

New England carbide tipped form tools must be seen — *and used* — to be appreciated. The generous tips are ground and lapped to specified forms and tolerances — *exactly*. You can be sure of this, because every New England tool is checked and double checked on the most up-to-date optical inspection equipment.

New England Carbide Tool Company is headquarters for the tough jobs. Call on us for quotations on complicated, unusual or special form tools that must be right — *exactly!*

Other special carbide tipped tools manufactured by New England Carbide Tool Company include reamers, centers, boring and skiving tools, drills, counterbores, trepanning tools, etc.

ALL KINDS OF CARBIDE PRODUCTS • DIAMOND TOOLS • DIAMOND POWDER •

NEW ENGLAND CARBIDE TOOL COMPANY

Please send me further information on your special carbide tipped tools.

NAME_____ TITLE_____

COMPANY_____

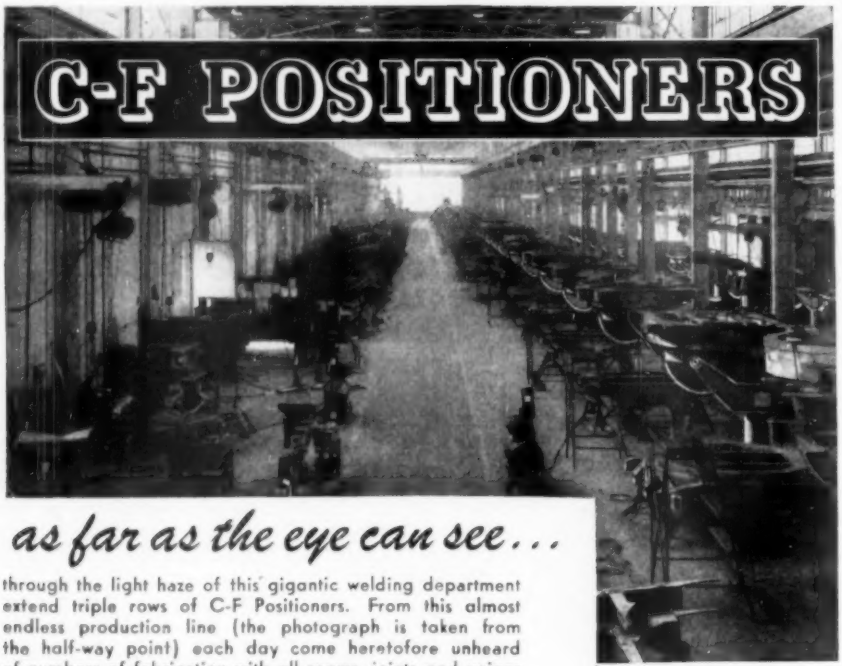
STREET_____

CITY_____ STATE_____

T.E.

60 BROOKLINE STREET • CAMBRIDGE 39, MASS.

C-F POSITIONERS



as far as the eye can see...

through the light haze of this gigantic welding department extend triple rows of C-F Positioners. From this almost endless production line (the photograph is taken from the half-way point) each day come heretofore unheard of numbers of fabrication with all seams, joints and unions strongly and smoothly welded "downhand".

There are no handling problems or delays, for on C-F Positioners each welder positions his weldment for succeeding welds with a pushbutton control—can rotate it at any desired speed (360°) or tilt it to any angle up to 135° beyond horizontal.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.
1318 S. Kilbourn Ave.
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BALDOR
BALL BEARING GRINDERS

for accurately sharpening

CARBIDE TOOLS

1-YEAR GUARANTEE

BALDOR CARBIDE TOOL GRINDER is precision-built for accurately and quickly sharpening Carbide Tools. Sturdy ½ H. P. heavy duty, ball-bearing, reversible Motor. Large adjustable tool-rest tables. Satisfaction guaranteed.

NEW LOW PRICE **$95.00**

WRITE FOR BULLETIN 307
BALDOR ELECTRIC COMPANY
4335 Duncan Ave. **St. Louis 10, Mo.**

BUILT BY MOTOR SPECIALISTS

CAN *You* USE THIS *Zagar* BROACHING MACHINE *for* $1200 ?

This husky, streamlined Zagar Broaching Machine is complete and self-contained. Just "hook 'er up and let 'er go!" Uses 3 h.p. motor; exerts 6000-lb. pull. Maximum stroke, 20". We can supply broaches of all kinds. QUICK DELIVERIES ON BOTH BROACHES AND MACHINES.

Get new Bulletin 700-E

ZAGAR TOOL, INC.
23880 Lakeland Blvd. **Cleveland, Ohio**

WILLEY'S
DIAMOND TOOLS

WILLEY'S Diamond Tools are back again. There's a complete line, with many new improvements.

WILLEY'S method permits the *complete* use of the diamond, or resetting if preferred, because the WILLEY'S Metal used for anchoring has machinable properties. Setting diamonds in WILLEY'S Metal so greatly prolongs their life that small diamonds will now dress a wheel that formerly required large, expensive stones.

WRITE FOR CATALOG 41

Gives complete information and prices of WILLEY'S Diamond Tools and mechanical dressers. Write today.

WILLEY'S CARBIDE TOOL CO.
SOLE MAKERS OF WILLEY'S METAL
1342 W. Vernor Highway **Detroit 1, Michigan**

DOUBLE GAGE PRECISION LIFE!

CUT DOWN REJECTIONS—
SPEED PRODUCTION—
SAVE TIME AND COSTS WITH

DUBLIFE

Reversible

PLUG GAGES

Both plugs, "Go" and "No Go", reversible in same handle.

Finer precision insured by exclusive UPPCO-Lapped finish.

Reversal of plug quickly done, on the job.

No doubts. No delay. Simply turn either plug end for end when worn, ***and you have a brand new gage!*** Plug easily locked in bronze split collet in moments. Handsome balanced hexagon handle. ***Save critical materials by using DUBLIFE!***

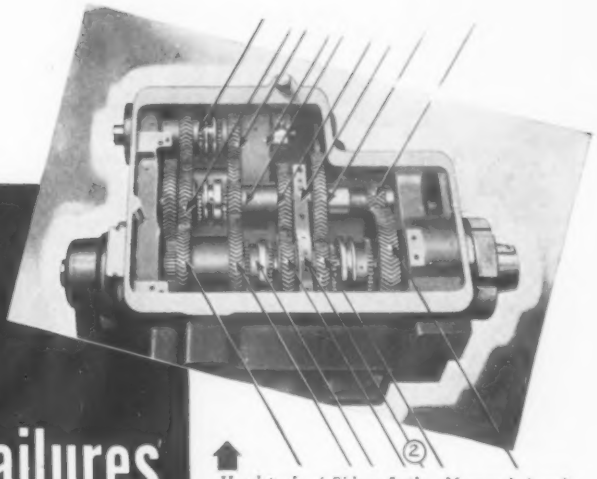
Send for Complete Catalog

Full line of DUBLIFE Gages with valuable gage data. Other gages of A.G. Design also shown.

UNITED PRECISION PRODUCTS COMPANY

3517 W. Belmont Ave., Chicago 18, Ill.

Guarded against costly failures



Headstock of Sidney Lathe. Numerals 1 and 2 point to center bearings; other arrows indicate 14 Ampco bushings in the gears.

. . . with bushings and center bearings of wear-resisting Ampco Metal . . .

Reg. U.S. Pat. Off.

AMPCO Metal

The Metal without an Equal

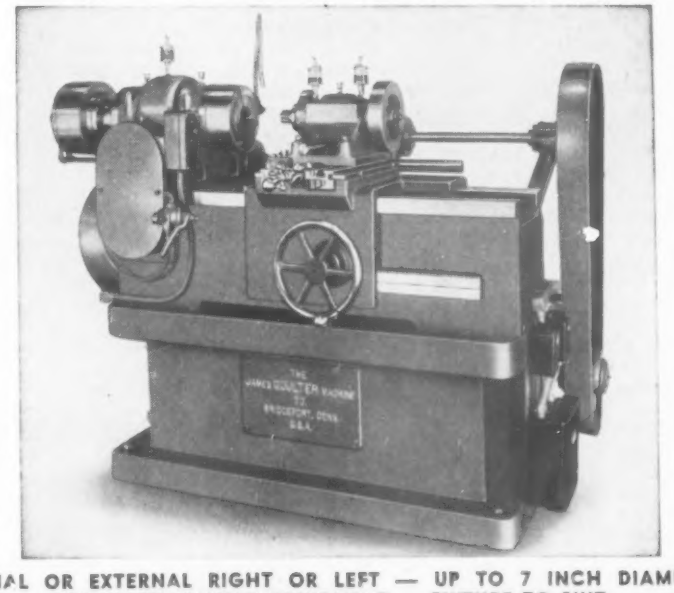
When you buy machine tools or other heavy equipment, it pays to check for parts of Ampco — the metal that stands up and gives several times the life of ordinary bronzes. Adopted by 90-odd leading machine tool manufacturers. • Write for bulletins which will aid you as a buyer and user of machinery — or help you specifically with your design problems involving wear, corrosion, shock, or other severe conditions.

Ampco Metal, Inc.

Department TE-5 Milwaukee 4, Wisconsin

PRECISION THREAD MILLER

FULL AUTOMATIC CONTROL



INTERNAL OR EXTERNAL RIGHT OR LEFT — UP TO 7 INCH DIAMETERS
COMPLETE MOTOR EQUIPMENT — FIXTURE TO SUIT

The James COULTER Machine Co.

BRIDGEPORT • CONNECTICUT • U. S. A.

A. S. T. E. DOINGS

● National A.S.T.E. Headquarters: 2567 W. Grand Blvd., Detroit 8, Mich. Telephone TYler 5-0145. National Officers: (1944-45 term): President, D. D. Burnside; 1st Vice-President, C. V. Briner; 2nd Vice-President, A. M. Sargent; 3rd Vice-President, W. B. Peirce; Secretary, E V. Johnson; Treasurer, F. W. Eaton; Assistant Secretary-Treasurer, L. G. Singer; Executive Secretary, A. L. Potter.

● For application blanks and information pertaining to membership in the American Society of Tool Engineers, address the Secretary's office, 2567 West Grand Boulevard, Detroit 8, Michigan.

● Senior initiation fee is five dollars. Dues eight dollars per year for senior grade membership and five dollars per year for junior grade membership. Junior initiation fee is five dollars.

Atlanta: S. W. Barnett, Production Research Department, Bell Aircraft Corp., Georgia Division, was principal speaker at the April 5 meeting held at the Henry Grady Hotel. He talked on "Forming With Rubber."

New officers installed are: Chairman, C. E. Brownell; vice-chairman, J. Childs; 2nd vice-chairman, J. M. McDonald; secretary, J. Borom, and treasurer, M. Otey.

Binghamton: Glen H. Stimson, Manager of the Sales Gage Division of Greenfield Tap & Die Corp., was principal speaker at the April 5 meeting held in the Spanish Ballroom of Hotel Arlington. Mr. Stimson was assisted by Paul T. Irvin, district engineer.

The talk, "Thread Gages and Gage Practice," was illustrated and covered all types of thread gages, thread gage tolerances, and the application of certain types of thread gages to various types of work. Attendance was 89 members and 12 guests.

Buffalo-Niagara Frontier: Ray H. Morris, national president, addressed the March 16 meeting held at the Trap & Field Club. He talked on the progress and growth of the society and the economic situation in general, after which he installed new officers. Following the installation a floor show was presented by George Keller.

Chicago: Approximately 200 tool engineers and visitors attended the April 3 meeting held at Huyler's restaurant.

Chairman Frank Martindell installed new officers for the coming year after which new chairman J. R. Miller took over the meeting and asked for a rising vote of thanks to Mr. Martindell and other officers for their work during the past year. He then presented past chairman pins to Frank Creagar, Clifford Ives, Sven Goransson, and Mr. Martindell.

Although no technical session was held, motion pictures entitled "Baptism of Fire" and "War Department Report," produced by the War Department, were shown.

Cincinnati: H. D. McLarty, director of Research Division, McLarty Business Films, was technical speaker at the April 14 meeting held at Dean Herman Schneider Memorial Building.

The talk, "Ultra High-Speed Motion Pictures and Their Application To Industry and Research," presented a brief discussion on the history and development of high-speed photography in its present function in the analysis and study of high-speed motion. The talk was accompanied by a film illustrating the principles involved, comparison with normal motion pictures, and a number of industrial applications. Officers for the current year were installed at the meeting.

National Secretary Earl V. Johnson (left) administers oath of office to new officers of Toledo chapter at installation night ceremonies April 12. Those inducted are (left to right): Chester A. Colwell, chairman; Val G. Kessler, second vice-chairman; Robert L. Wigel, secretary; Samuel W. Burgess, first vice-chairman, and Roy Dusseau, treasurer.

Cleveland: Werner I. Senger, manager of the Balancing Machine Division of Gisholt Machine Co., was chief speaker at the April 14 meeting.

His talk "Dynamic Balancing," was illustrated with slides and covered the fundamentals of dynamic balancing as compared to static balancing.

Roy C. Scott, assistant U. S. district attorney, was coffee speaker. He talked on "The Japanese Fifth Horseman" and discussed Japan's plan for world domination by systematic introduction of narcotics to the people of occupied countries and countries marked for conquest.

Columbus: A. A. Cambria, chief engineer of Lapointe Machine Tool Co., was technical speaker at the April 18 meeting held in the Crystal Room of the Hotel Fort Hayes.

With slides and verbal explanation he presented a short history of broaching and showed regular types of broaches and a number of special machines, tools, and setups.

Dayton: Walter Ernst, director of engineering, Hydraulic Press Mfg. Co., was guest speaker at the April 10 meeting, held at the Engineers' Club.

He presented a history of modern plastics, types of plastics, and methods of production now generally used. R. W. Powell, also associated with Hydraulic Press, presented motion pictures on plastics. Officers for the ensuing year were installed.

Decatur: Marvin E. Mundel, ass't. professor of industrial engineering at Purdue University, spoke on "Modern Industrial Engineering" at the April 5 meeting held at the Decatur Club.

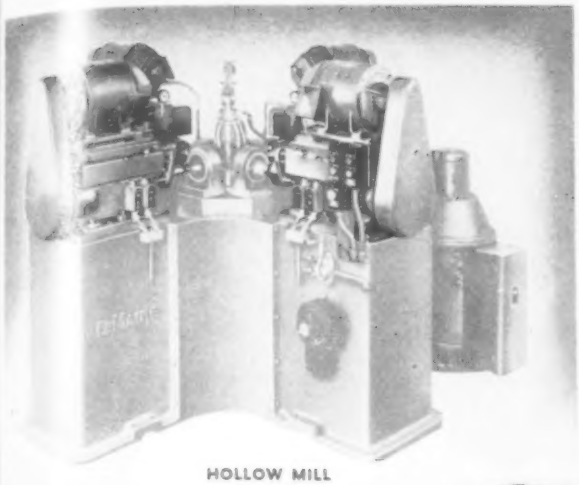
His talk covered the application of time and motion study of the job and how these studies have proved valuable on various applications. The talk was illustrated by a film entitled "Make Every Minute Count."

Detroit: P. V. Keyser, Jr., chief research chemist, and J. T. Beard, chief of technical division, both of Socony-Vacuum Oil Co. Inc., were technical speakers at the April 13 meeting held in the Spanish Room of the Fort Shelby Hotel.

Mr. Keyser talked on "Trends in the Development of Cutting Fluids." Mr. Beard gave an illustrated talk cov-

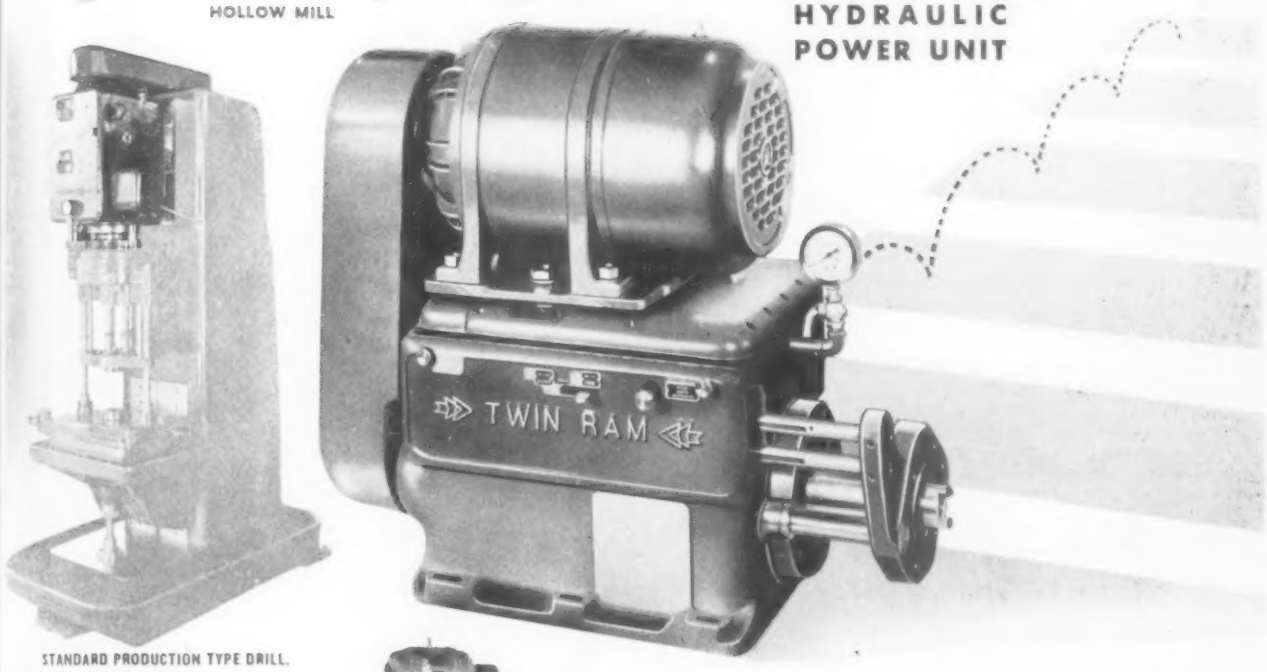
(Continued on page 202)

IT'S SIMPLE "To Make" A MACHINE NOW —if You Have a TWIN RAM MASTER UNIT

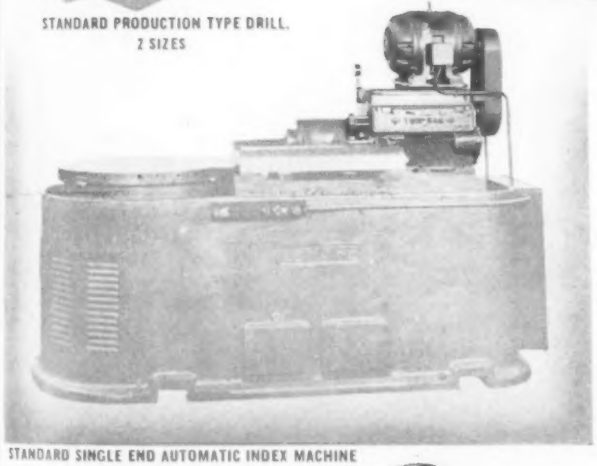


HOLLOW MILL

A COMPLETE SELF-CONTAINED HYDRAULIC POWER UNIT



STANDARD PRODUCTION TYPE DRILL. 2 SIZES



STANDARD SINGLE END AUTOMATIC INDEX MACHINE

YOU CAN change this unit from one base to another, or rearrange your setup on the same bed, as your requirements dictate. It's practically as flexible as a motor; only pick-off gears necessary for speed changes—units provide infinite feeds. Twin Ram Unit can be used for wide range of applications — drilling (single or multiple spindle), reaming, milling, hollow milling, boring, counterboring, spotfacing. Uniform pressure behind load is always in a straight line — the two rams prevent twisting action. Two sizes available. Capacity up to 2" in steel. Can be made to operate manually or automatically by remote control — for either right or left hand operation — with spindle rotation in either direction.

Send for folder giving complete information — spindle speeds and feed rates.

We invite inquiries regarding postwar plans.

BUY WAR BONDS

LeMaire TOOL & MFG. CO.

2663 S. TELEGRAPH ROAD ▲ DEARBORN, MICHIGAN

ENGINEERS AND BUILDERS OF PRODUCTION MACHINES

ering applications of particular interest to the tool engineer. Also on the program was a short, slow-motion picture showing types of chip formation and the behavior of the built-up edge. Approximately 300 persons attended the meeting.

Elmira: A. H. Moore, electric-control specialist, General Electric Co., was principal speaker at the April 10 meeting.

Mr. Moore gave a demonstration and talk on the operation of Thy-Mo-Trol, the electronic drive which maintains constant speed with variable loads. Also on the program was the showing of a movie "Years of Progress," showing advanced engineering practices used in the automotive industry for testing and checking material.

Erie: William S. "Bill" Jack, president of Jack & Heintz, was principal speaker at the April 4 meeting held at the Masonic Bldg.

Coffee speaker and toastmaster at the meeting was C. V. Briner, 1st vice-president.

Fairfield County: Past national president Frank W. Curtis spoke at the April 5 meeting on "The Advantages of Membership in the A. S. T. E."

Also on the program was a film entitled "Die Casting" presented by R. G. Kenly, factory representative of the New Jersey Zinc Co. Following pre sentation of the film, Mr. Kenly explained the details of die casting and discussed some of his company's experiences with the process.

Fond du Lac: Technical speaker at the April 14 meeting held at the Conway Hotel in Appleton, Wis., was R. Esch, representing Vickers, Inc.

Mr. Esch spoke on "Hydraulics As Applied To Machine Tools." Moving pictures also were included on the program.

Fort Wayne: More than 100 persons turned out for the April 12 meeting at the Chamber of Commerce Building, to hear George H. Sanborn, chief field engineer of Fellows Gear Shaper Co., talk on "Gears At War."

Mr. Sanborn emphasized the increased benefits and efficiency derived from gears machined to closer tolerances and closer inspection. His talk was supplemented by two gear films and an educational film entitled "The Battle Of Britain."

Also on the program was an address by Ernest J. Gallmeyer, sales manager of the Wayne Pump Co. He talked on "Post-War Frontiers."

Golden Gate: W. DeBoer, superintendent of the Universal Engraving and Colorplate Co. of Cleveland, presented a talk on inspection control with precision charts at the March 13 meeting held at the Engineers' Club in San Francisco.

Mr. DeBoer showed an elaborate display of charts dealing with inspection control. Newly elected officers were installed at the meeting and past chairman pins were presented to [illegible] Horack, Karl Bues, and Walter K[illegible]ebohm.

Greater New York: Technical speaker at the April 3 meeting held at the Hotel New Yorker, was E. H. Johnson, president of Johnson Tool & Engineering Co., Inc. He spoke on "Special Machinery in The War Effort." His talk was supplemented by illustrated slides and sound movies. Also on the program was a movie entitled "The Battle of the Beaches."

Hamilton: J. E. D. Hastie of The Carborundum Company was principal speaker at the April 14 meeting held at the Welland House, St. Catherines, Ont. Mr. Hastie spoke on "First Principles in Grinding."

Hartford: R. S. Drummond, president of the National Broach & Machine Co., was principal speaker at the April 3 meeting held at the City Club. He talked on "Gears and Present Trends in Gear Manufacture."

His illustrated talk included a discussion of elliptoid tooth form and gear shaving as well as other general gear data.

A feature of the meeting was the attendance of seven past chairmen of the chapter. They were A. H. d'Arcambal, Irwin F. Holland, Ray Morris, Frederick L. Woodcock, Henry L. Moore, Harry J. Hauck, and Carl Moeller. W. B. Peirce, 3rd vice-president, spoke

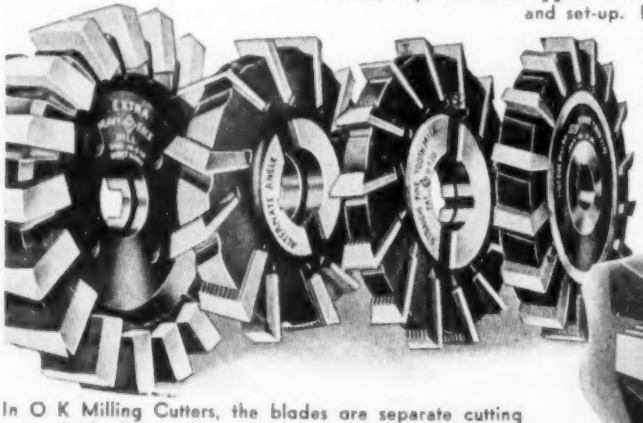
(Continued on page 204)

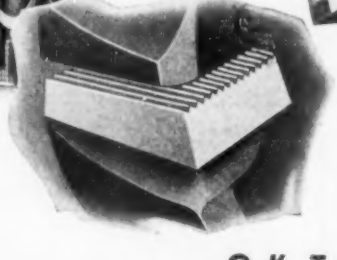
NEGATIVE RAKE & SPIRAL MILLING CUTTERS

FOR MACHINING STEEL AT HIGH SPEEDS

The O K Tool Co. not only originated Inserted-Blade Milling Cutters but also pioneered the successful adaptation of these cutters to negative rake and spiral milling.

This type of milling, a "shearing" cut from rear to point of blade which leaves a high finish on steel, requires extra rugged construction both in cutter and set-up. Extreme strength and rigidity are outstanding characteristics of O K Inserted-Blade Milling Cutters, due to the very high grade material and to the effective locking mechanisms employed.





In O K Milling Cutters, the blades are separate cutting units; the bodies are of drop-forged steel. The blades are held securely in mating serrations—always easy to adjust or renew. No pins, no set-screws, no wedges. Made in a wide variety of styles and sizes for all types of metal cutting machines.

O K Tools Are Available for Every Metal Cutting Need

TRADE O K MARK **SYSTEM**
OF INSERTED-BLADE METAL CUTTING TOOLS

THE O K TOOL CO., SHELTON, CONN.

The forging of metal parts is and always has been the basic process in mechanical progress, whether in peace or in war.

Utmost strength and toughness with minimum weight is attained only in drop forging—more properly termed "impact die-forging." For it is the impact of the blow of the upper die on the hot metal resting in the lower die that gives to that metal the improved physical properties that fit it to withstand "unpredictable" loads and stresses.

Modern drop hammers—Chambersburg Hammers—have been responsible for the great progress in drop forging through (1) precision of operating mechanism, (2) increased ram velocities and (3) increased anvil-to-ram weight ratios.

Thus to the basic importance of forging has been added the refinement of scientific hammer design and manufacture.

Chambersburg Engineering Company
Chambersburg, Pennsylvania

briefly on the work being done by the Chapter.

Houston: Approximately 250 members and visitors attended the joint meeting with the Houston chapter of the American Society for Metals March 14.

Following the appointment of committee chairmen by L. M. Krausse, chairman, C. E. Betz, vice-president, Eastern Division, Magnaflux Corporation, gave a talk on "Interpretation and Evaluation of Indications" in the Magnaflux process of testing for defects in materials.

Indianapolis: The executives night meeting was held April 6 in the Riley Room of the Claypool Hotel. H. D. (Pop) Hiatt, 1st chairman of the chapter, gave a brief history of the chapter since it was chartered in 1940.

Dr. Hilton I. Jones, manager and director of Hizone Research Laboratories, was principal speaker at the technical session. He spoke on "Peeps at Things to Come." He discussed developments in chemistry and enumerated many products envisaged in this field. Approximately 220 persons attended the meeting.

Kansas City: Walter Smith, a chapter member, reported the proceedings of the Philadelphia Convention at the April 5 meeting held in the Pine Room at the Union Station.

Substituting for the scheduled program speaker who was unable to attend because of illness, A. Jackson Mirick, chapter chairman, filled in by demonstrating one of his company's blow valves made as a regular production item both before the war and for military use. Also on the program was the showing of a film of the manufacture of tungsten-carbide-tipped tools.

Louisville: Bradford Reed, president of the Roll Thread Die Co., was technical speaker at the April 11 meeting held in the Kentucky Hotel.

Mr. Reed spoke on "Thread Rolling, Its Mechanics and Application," using slides to illustrate his subject. About 125 persons attended the session.

Milwaukee: Following installation of officers for the ensuing year, at the April 13 meeting, Robert Gustaveson, field engineer for the Milwaukee Metal Spinning Co., spoke on "The Art of Metal Spinning." He illustrated his talk with pictures and with products made by his concern.

Following his address, an open forum was held in answer to a question asked by one of the members on induction heating for brazing and soldering operations.

Montreal: Dr. H. A. Frommelt, director of the Research Department of Kearney & Trecker Corp., was speaker at the April 12 meeting held at the Windsor Hotel.

Dr. Frommelt spoke on "High Speed Milling of Steel with Carbide Cutters." His talk covered the subject of milling machines and their application in the metal-working industries. His address was accompanied by the showing of a 30-minute film with running commentary.

New Haven: At the April [illegible] meeting held at the Duncan Hotel, A. A. Cambria, chief engineer of the [illegible]apointe Machine Tool Co., talked on "Present and Post-War Broaching." His talk covered a short history of broaching, new developments, the evolution of broaching to general machining operations, and advantages of converting to broaching in the post-war period. Swan Esborn, of O. F. Mossberg & Sons, Inc., was technical chairman.

North Texas: Maj. Alexander P. De Seversky, outstanding aviation authority and designer and builder of the P-47 Thunderbolt fighter plane, addressed the March 20 meeting at the Will Rogers Municipal Auditorium in Fort Worth.

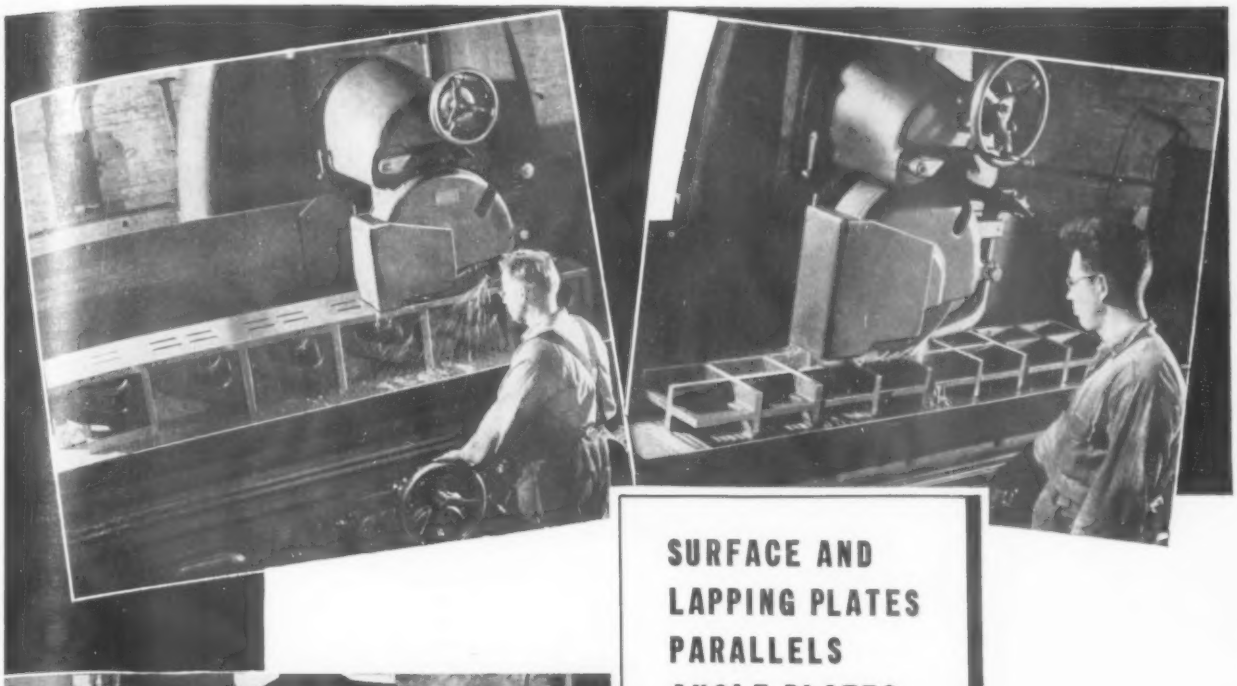
Subject of his talk was "Victory Through Air Power," the title carried by his best-seller book. Approximately 2,000 persons attended the meeting.

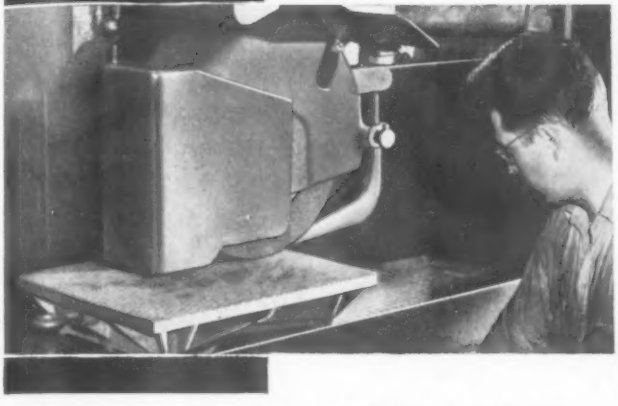
New officers for the ensuing year are: Chairman, Irving H. Buck; 1st vice-chairman, John H. Smith; 2nd vice-chairman, Fred Bates, Jr.; secretary, John A. Lapham, and treasurer, Claude N. Wilson.

Peoria: Speaking on "Jig Boring And Its Application", F. O. Hoagland, master mechanic, Pratt & Whitney Di-

(Continued on page 206)

MORE PRODUCTION PER MAN HOUR
These smaller size Niagara Inclinable Presses offer the same design features of larger Niagara models. The instant acting 14-point sleeve clutch is an important factor in increasing the output per man hour. It is possible that one or more of these presses can help you in speeding up production of urgently needed wartime material.
A1
A1½
A2
A2½
A2½
NIAGARA
NIAGARA MACHINE & TOOL WORKS
BUFFALO, 11, N. Y.
DETROIT • CLEVELAND • NEW YORK
BUY UNITED STATES WAR BONDS AND STAMPS





SURFACE AND LAPPING PLATES
PARALLELS
ANGLE PLATES
STRAIGHT EDGES
UNIVERSAL ANGLES
V BLOCKS

PRECISION GROUND TO EXACTING SPECIFICATIONS

For years E. H. Hasselkus Company, Milwaukee, Wisconsin has been grinding gauges and tools for inspection — layout — assembly and general production. The examples shown above are all "tenths" jobs where the overall flatness, squareness and accuracy are held to very close limits. Not only is the work ground to exacting specifications, but important savings have been effected through the substitution of grinding for the previous method.

Here is another example, showing how Mattison Grinders are proving their worth in the production of parts where close precision is required. They incorporate massive, double cloumn support for wheel head, ruggedness of construction and ample power for rapid stock removal that insures consistent precision results on a high production basis.

Write for the free Set-Up Book, containing further examples, showing how others have reduced time and increased production with Mattison Grinders.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

vision of Niles-Bement-Pond Co., addressed the technical session of the April 4 meeting held at Hotel Jefferson. He supplemented his talk with pictures.

Carl Holmer, regional director, gave a report on the national convention at Philadelphia.

Philadelphia: At the March 16 meeting held at the Engineers' Club and designated as Bendix Night, T. W. Tinkham, general manager Philadelphia division, Bendix Aviation Corp., spoke on "Tool Engineering from Management's Point of View."

Chapter officers for the ensuing year are: Chairman, Foster M. Crayton; 1st vice-chairman, Adolph E. Berdick; 2nd vice-chairman, W. B. Rapp; secretary, W. Warren Cady; and treasurer, Howard W. Gross.

Charles Crook, chairman of the education committee, gave a five-minute talk on the A. S. T. E. sponsored punch, die, jig, and fixture designing classes and asked for volunteer instructors at the April 20 meeting.

L. E. Osborne, of the Westinghouse Electric and Mfg. Co., talked on postwar planning. C. P. Pearce, spoke on electronics and presented a Westinghouse film, "Electronics at Work."

Pittsburgh: Guest speaker at the April meeting held at the Fort Pitt Hotel, was Patrick J. McCarthy, metallurgical engineer and supervisor of the Tool Standard Department of Aluminum Company of America.

Mr. McCarthy spoke on design and material standardization showing considerable saving in time and material and greater efficiency obtained through use of standardization. Following his address, a movie was shown covering the growth in the production of aluminum from its discovery up to the present time.

Portland (Ore.): J. T. Hood, sales engineer, General Electric Co., addressed the April meeting at Mallory Hotel.

He talked on "Action of Metal-Cutting Tools as Seen Through the High-Speed Camera." Also on the program was a movie, "How to Machine Aluminum."

Technical speaker at the March 15 meeting was W. DeBoer of the Universal Engraving & Colorplate Co., Cleveland. He talked on optical comparator charts, and presented various samples of the charts to illustrate his talk.

Also on the program was the showing of a new sound film entitled "Production Thread Grinding," provided by Jones & Lamson Co.

Potomac: H. Gotberg, chief engineer of Colonial Broach Co., gave an interesting talk, entitled "Modern Broaching Methods," to approximately 125 members at the April 6 meeting. His talk was accompanied by slides illustrating broaching technique, and a motion picture in technicolor showing actual broaching applications. Mr. Gotberg was accompanied by Carl Halborg, president; David Lundell, secretary-treasurer, and LeK[illegible] Dahlberg, all of Colonial Broach C[illegible]

Also on the program was th[illegible]owing of movies presented through [illegible] courtesy of Allegheny Ludlum St[illegible] Corp. on "Exploring with the Mi[illegible]imer" and "Manufacture of Stainless Steel."

Rochester: Installation of offi[illegible]rs and an address by Ray H. Morris, [illegible]en national president, were feature[illegible] of the March 14 meeting held at Sa[illegible]amore Hotel. Also on the program was the showing of a colored film by W. Reuen Fisher, secretary of Universal Engineering Corp., entitled "Hunting Expedition in the Summer of 1943 in British Columbia and Alaska."

Approximately 125 persons attended the April meeting held in the Strong Auditorium, University of Rochester. The dinner speaker was Victor Noel of the Ritter Dental Co., who gave a talk on his experiences as a sales representative during 13 years service in Paris prior to the present war.

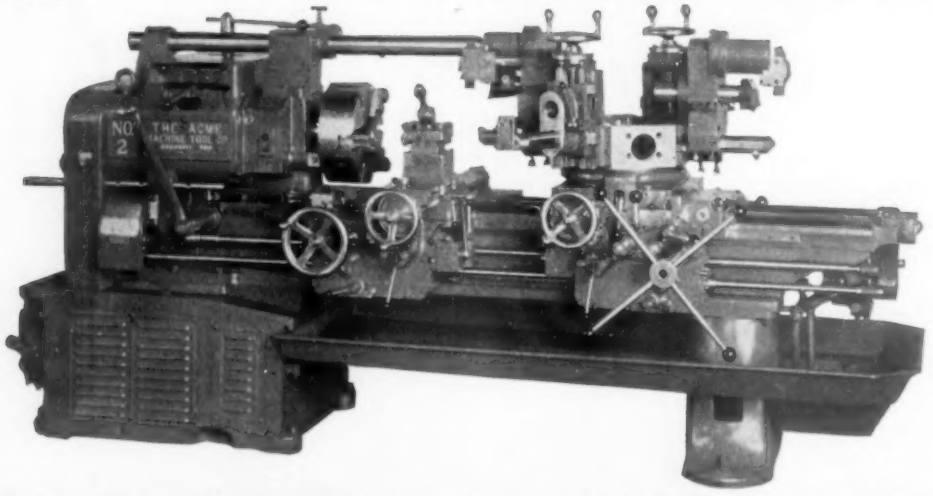
Technical speaker was A. A. Cambria of the Lapointe Machine Tool Co., who gave an address on present day broaching, illustrated by photos of new machines and tools.

Rockford: The highlight feature of the dinner hour at the April 6 meeting at the Faust Hotel, was an address by Raymond Johnson, shipfitter, third class, USN, who related his experiences in the North African campaign. Honorably discharged, he appeared through

(Continued on page 208)

CINCINNATI
ACME
UNIVERSAL
TURRET LATHES

SPEED PRODUCTION--SAVE TIME



GREATER RIGIDITY AND ACCURACY UNDER HEAVIER CUTS AT FASTER SPEEDS!

The above illustrated No. 2 ACME Universal Turret Lathe with its stationary overhead pilot bar and headstock brackets together with rigid turret tooling permits heavy multiple cuts. These features assure accuracy while faster speeds are possible through the use of cemented carbide cutting tools. This machine features heavy duty multiple turning heads and vertical side tools and heavy duty reversible cutter holders. Also shown is the lead screw type chasing attachment with split nut brackets and threading dials on both carriages. • WRITE FOR COMPLETE DETAILS.

THE ACME MACHINE TOOL CO. 4955 SPRING GROVE AVE., CINCINNATI 32, OHIO

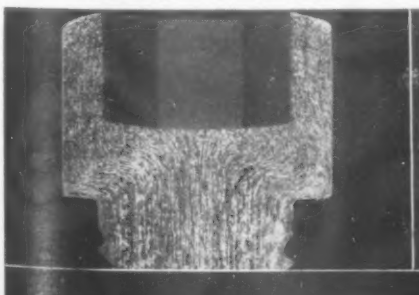
Start RIGHT .... *Seat* RIGHT

PARKER-KALON SOCKET SCREWS

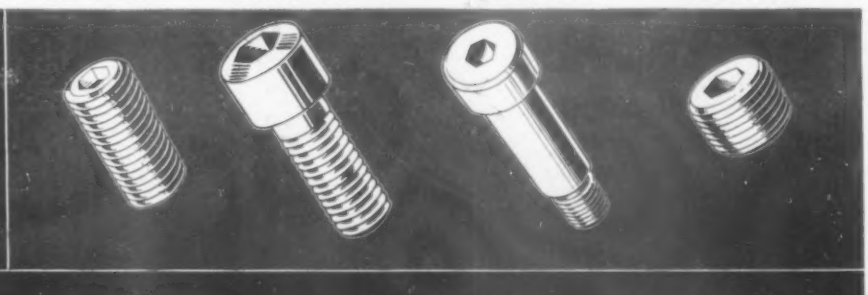
Parker-Kalon's Quality-Control rules out trouble in starting and seating P-K Cold-forged Socket Screws. Threads MUST be clean cut and free of nicks and burrs. They MUST be accurately formed and true to pitch and lead. Heads MUST be concentric with the shank and the diameter held to close tolerances.

Starting when raw material enters the P-K plant, and ending only when the finished screws are packed, the P-K Quality-Control routine checks every mechanical and physical characteristic. Tests and inspections cover Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Torsion and Shear; Hardness; Head and Socket Size and Position; Thread Fit. Parker-Kalon Corp., 208 Varick St., New York 14.

COLD-FORGED FOR STRENGTH



SET SCREWS CAP SCREWS STRIPPER BOLTS PIPE PLUGS



A Product of **PARKER-KALON**--*Specialists in Fastening Devices*

the cooperation of the Diamond Tool Company.

Technical speaker was Dr. Harry B. Osborne, Jr., representing the Tocco division of the Ohio Crankshaft Co. He talked on "Induction Heating at War Today—at Peace Tomorrow." Approximately 150 members and guests attended the meeting.

San Diego: Feature of the April 14 meeting at the San Diego Club was presentation of a new device for use in manufacture of airframe structures and other large assembly units.

Conceived by Leland A. Bryant, consulting engineer for Consolidated Vultee Aircraft Corp., the device is known as The Master Tooling Dock.

Also on the program was a talk on dimensional control by F. H. White, of Federal Tool and Supply Co. He discussed dial gage indicators, supplementing his address with sound films.

Schenectady: The chapter sponsored a social evening April 7 at the television studio of radio station WRGB. The meeting included a television exhibit and demonstration.

Seattle: Twenty-six members and three guests attended the March 16 meeting held at Jorgensen's Restaurant.

Guest speaker was W. DeBoer, representative of the Industrial Engineers Specialty Division of the Universal Engraving and Colorplate Co., Cleveland. He talked on "Precision Inspection and Projection Inspection". An open forum followed his address.

South Bend: Rupert Esser, chief engineer, and Don Thomas, sales department, both of Logansport Machine Co., Inc., were technical speakers at the April 11 meeting held at the Indiana Club.

Mr. Esser talked on "The Installation of Air and Hydraulic Equipment on Machine Tools." Mr. Thomas followed with a talk on "Representative Machine Installations of Air and Hydraulic Equipment." Both addresses were augmented with slides. Forty-five members and guests attended the dinner and 56 were present at the technical session.

Springfield (Mass): Principal speaker at the April 10 meeting held at the Highland Hotel was J. K. Penny, president of U. S. Broach Co. He talked on "Broaches and Broaching Problems."

Also on the program was an address by Henry B. Browne of the metallurgical Equipment Co., who talked on "The Identometer" and "The Magnetic Comparator." He later demonstrated the instruments, used for checking steel. Frank Curtis, past national president, gave a brief report on progress of the new handbook. Seventy-nine members and guests attended the meeting.

Springfield (Ill.): J. V. Javorsky, chapter chairman, gave a talk on "Environment and Its Effect on our Work" at the April 12 meeting, held at the Knights of Columbus Bldg.

Technical speaker was W. [illegible] Oldacre, president and general [illegible]anager of the D. A. Stuart Oil Co. [illegible] talked on "Cutting Fluids and Tool [illegible]signs," using slides to illustrate his a[illegible]ress.

St. Louis: At the April 6 [illegible]eeting, Douglas D. Burnside was ac[illegible]rded a rousing welcome in recognition of his recent election as national president at the Philadelphia Convention. Past chairman, Clarence L. Miller, presented a brief outline of the new president's activities in the society.

Technical speaker was F. O. Hoaglund, master mechanic of Pratt & Whitney Division, Niles-Bement-Pond Co., who discussed the origin of methods for obtaining measurements of accuracy. He presented slides covering the proper use of jig boring machines and the most efficient methods of engineering layouts of jig boring problems.

Syracuse: E. V. Flanders, representing Jones & Lamson Machine Co., was technical speaker at the April 11 meeting. His subject was "Development and Operation of The Thread Grinder."

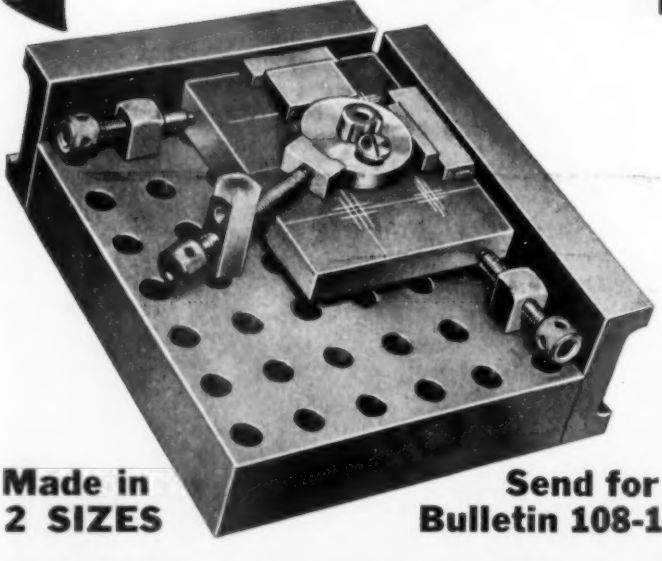
Adrian L. Potter, national executive secretary, attended the meeting and gave a short talk. Approximately 250 persons attended the meeting.

New officers installed at the March 7 meeting by regional director H. B. Mozeen are: Chairman, Don Babcock; vice-chairman, Emil Floring; 2nd vice-chairman, Ray Coseo; secretary, Les-

(Continued on page 210)

Eliminate COSTLY MACHINE TOOL Equipment

WITH THIS ANGLE PLATE "HOLOCATOR"



Made in 2 SIZES

Send for Bulletin 108-1

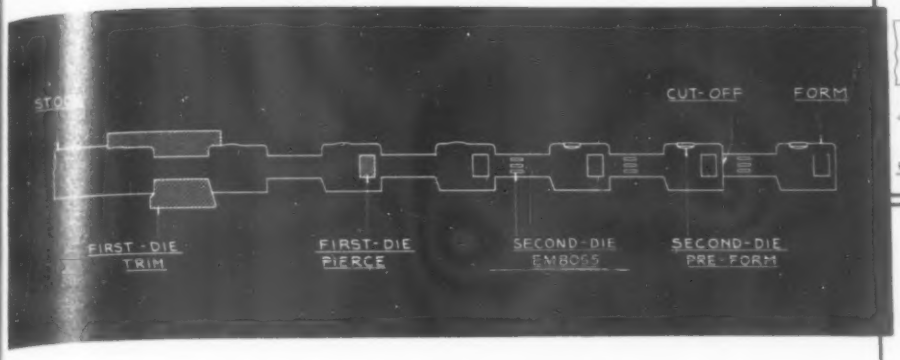
For accurate locating of all drilled and reamed holes and the laying out of dies and drill jigs, you can perform this task on any drill press very quickly with this tool-makers' device.

This precision device will take care of about 75% of the work that has to be performed on the average Jig Boring Machine.

This "Holocator" can also be used to advantage as a universal precision drilling and reaming jig, where accurate duplicated parts are required in small lots and where ordinarily a special jig would be required.

DAYTON ROGERS MFG. CO.

2853 Twelfth Ave. So.
MINNEAPOLIS 7
MINNESOTA



METAL STAMPINGS

Requiring Intricate Forming Now Produced with Increased Speed

This part is a metallic belt link used for holding .30 cal. machine gun bullets. Formerly, nine punch presses were employed to complete the piece, each requiring the services of one operator. Seeking means of stepping up output, the manufacturer was led to investigate the possibility of handling the part in the U. S. Multi-Slide. Our engineers developed a method of tooling that enabled production of the part from coil stock — complete, without further handling — in a No. 33 U. S. Multi-Slide Machine with two die heads and a cut-off slide. Result: One Multi-Slide Machine easily handles the complete job at a higher production rate than all nine punch presses formerly required — 85 complete parts per minute as against 65 under the previous method! Also one operator could attend to a battery of Multi-Slides whereas a separate operator was required for each of the nine punch presses.

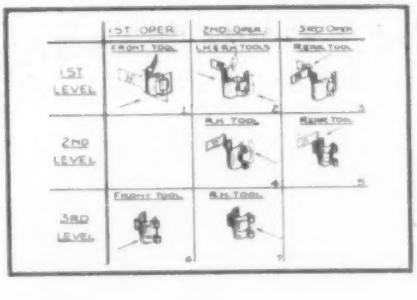
Note the 7 intricate forming operations required after cut-off, and how ingeniously they are performed on three different levels by the U. S. Multi-Slide (drawing and diagrams below and at right).

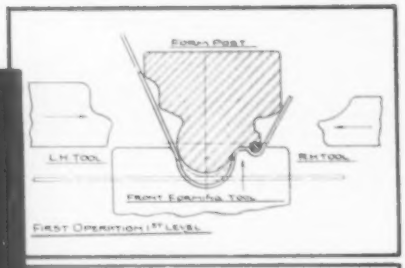
Your production program may call for the fabrication of intricate metal parts that could be handled to advantage in the U. S. Multi-Slide. If so, why not send us samples or blueprints? We shall be glad to submit our recommendation on equipment for your work. Ask for your copy of Bulletin T15.

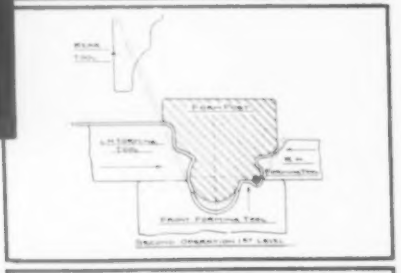
SEQUENCE OF OPERATIONS

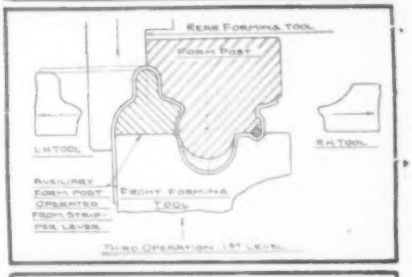
(See Diagrams, below and at the right)

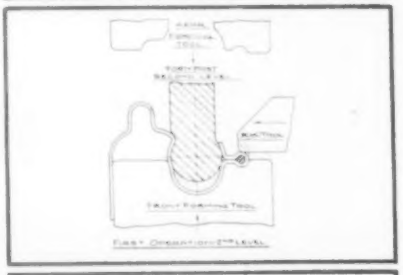
Material is fed into machine (extreme left). In 1st die head, blank is trimmed and pierced. In 2nd die head, blank is embossed and pre-formed. In cut-off slide, blank is cut off from strip of material, then enters forming position for completion. Forming is accomplished on three different levels, with 3 operations at first level, 2 operations at second level, 2 operations at third level—and the part is completed. For interesting views showing contour of part at each of the 7 forming operations, see drawings at the right.

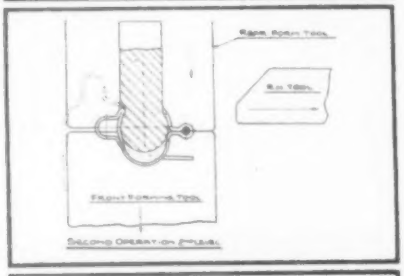


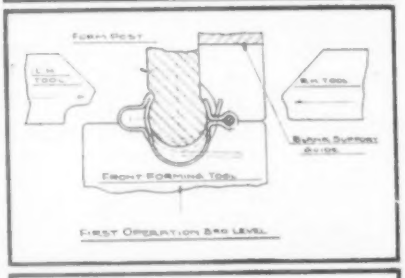


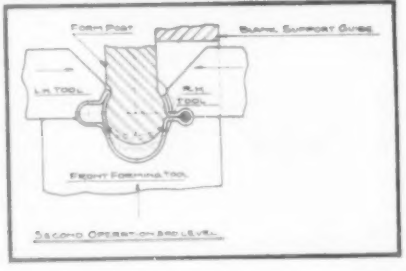












The U. S. MULTI-SLIDE

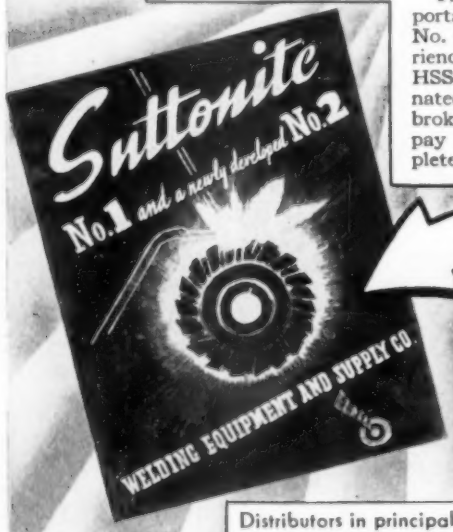
U. S. TOOL COMPANY, INC., AMPERE (EAST ORANGE), N. J. Builders of the U. S. Multi-Slide, U. S. Multi-Millers, U. S. Automatic Press Room Equipment, U. S. Die Sets and Accessories.

NOW you can RECLAIM HIGH SPEED STEEL TOOLS by WELDING right in YOUR OWN PLANT!

with Suttonite No. 1 AND A NEWLY DEVELOPED No. 2

The Welding Equipment & Supply Co. (originators of "SUTTONIZING", the first successful welding process for reclaiming HSS Tools) announce their recent development of SUTTONITE No. 2 Drawn Alloy Welding Rods, which with SUTTONITE No. 1 now make it possible for you to reclaim your high speed steel cutting tools by welding right in your own plant.

This announcement is of vital importance for, with SUTTONITE No. 2 the customary hazards experienced in the welding of broken HSS cutting tools has been eliminated. If you want to repair those broken tools in your plant it will pay you to wire or write for complete information today.

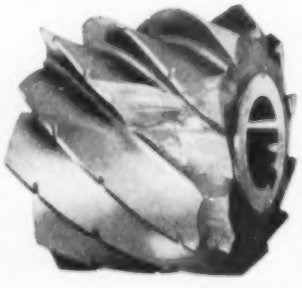


Here's the booklet that tells all about SUTTONITE No. 2 and how to use it in your plant. Don't fail to send for it today!

Distributors in principal cities of the United States and Canada.

WELDING EQUIPMENT & SUPPLY CO.
223 LEIB STREET • DETROIT, MICHIGAN

EXAMPLES of TOOLS that can be RECLAIMED RIGHT IN YOUR OWN PLANT WITH SUTTONITE



6" x 5" x 2" slab mill with teeth fractured.

SUTTONITE No. 1 and No. 2 are used to reclaim milling cutters, broaches, drills, ball and end mills, reamers, taps, cutting tools for lathe, planer and shaper and special shape forming tools.

Same Slab mill as reclaimed by "SUTTONIZING." Also rough ground.

William E. Farrell was elected second vice-chairman of the Twin States Chapter in elections held recently.

ter Collins, and treasurer, Hugo Klix. Earl Dougherty, service engineer of Whitman & Barnes Co., addressed the technical session of this meeting, speaking on twist drills and reamers.

Toledo: Officers for the ensuing year were installed at the April 12 meeting held at the Commodore Perry Hotel by Earl V. Johnson, national secretary. Those inducted are: Chairman, Clester A. Colwell; 1st vice-chairman, Samuel W. Burgess; 2nd vice-chairman, Valentine G. Kesseler; secretary, Robert L. Wibel, and treasurer, Roy Dusseau.

Principal speaker at the technical session was Robert S. Drummond, president of National Broach & Machine Co., who talked on "Modern Production of Gears for Aviation, Range Finding, and Large Propulsion."

Toronto: Attendance at the March 10 meeting was the largest this year with 90 persons attending the dinner and an equal number coming later for the technical session.

J. R. Boyle, Canadian General Electric Co., was principal speaker. He talked on "Electronics, A New Science in a New World." His address was illustrated by sound movies and slides. Also on the program was the showing of a picture entitled "Fighting Ships."

Tri-Cities: Marvin E. Mundel, assistant professor of Industrial Engineering at Purdue University, was technical speaker at the April 3 meeting held at the Blackhawk Hotel in Davenport, Ia. His subject was "Motion and Time Study for Victory." Also on the program was the showing of a sound motion picture entitled "The Last Wilderness," depicting hunting in the Rocky Mountains with bow and arrow.

Twin Cities: At the March 15 meeting held in Minneapolis at the Covered Wagon, the following officers were installed for the ensuing year: Chairman, William E. Boker; 1st vice-chairman, W. A. Ahlberg; 2nd vice-chairman, John Harrington; secretary and treasurer, W. E. Erskine.

Following the installation, H. G. Populorum, representing the Federal Products Corp., presented a film on various types and applications of dial indicators used for inspection work in the aircraft industry.

Twin States: John Roll, of the Singer Sewing Machine Co., was technical

(Continued on page 212)

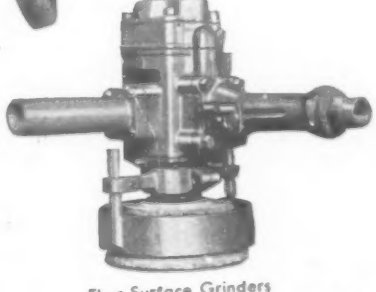
WITH THESE POWERFUL

Thor AIR GRINDERS

50 Thor Air Grinders For Every Type Of Job!

Thor Small Wheel Grinders

Thor Radial Wheel Grinders



Thor Surface Grinders

LOOK AT THE RANGE!

Number of Models	50
Wheel Capacities	1½" to 8" dia.
Speeds	3000 to 21,000 RPM
Lengths	5½" to 39"
Weights	18 oz. to 24 lbs.

...YOU'LL WASTE NO TIME ON GRINDING

To give you top speed for peak production grinding . . . to give you precisely the type of power, light weight, and extreme stamina that make it possible, THOR Air Grinders have these advanced construction features:

1. THOR "Air Behind the Blades" principle keeps the rotor blades out against the cylinder bushing wall, preventing dead center position and assuring *instant starting* under all operating conditions.
2. The solid one piece construction of the THOR rotor permits the use of deeper blade slots and wider blades. This greatly boosts the power and the rate of material removal.
3. The THOR Double-Acting Safety Governor acts to save time in two ways: It regulates spindle speed to the level of highest grinding efficiency for the size and type of wheel used. It prevents racing of wheels at dangerously high speeds even in event of mechanical failure of governor parts.

You will find these top speed construction features, plus others like THOR End Exhaust, Automatic Lubrication, and Labyrinth Seal on Spindle, in a complete line of THOR Air Grinders for every industrial application. For details, write for THOR Pneumatic Catalog No. 52B.

Thor *Portable Pneumatic and Electric Tools*

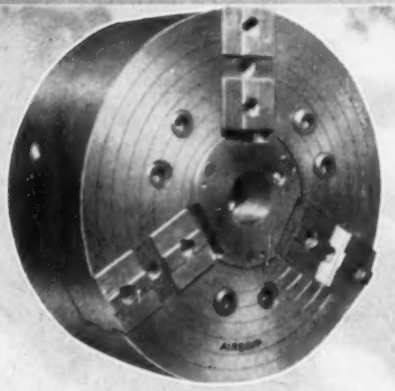
INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO, ILL.

Branches in Principal Cities

ZOOM PRODUCTION! SLASH COSTS!

with "Airgrip" Double-Action Devices



"AIRGRIP" CHUCKS

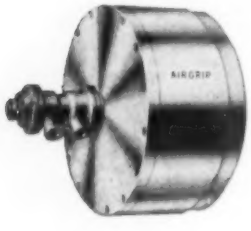
Your judgment will be *doubly* vindicated when you invest in "Airgrip" Chucks — (1) *Immediately,* because your output records will rise — 25% and more — and your manpower problem will be eased; (2) *Later On,* because the unit-cost-cutting achieved with these improved, lathe-modernizing chucks will enable you to meet returning competition.

"Airgrip" Chucks offer "two-fisted" *double gripping power* because of the cam's *wedge action* (which operates in *both* directions) and locks the jaws mechanically, whether gripping internally or externally.

Work is held tight even if air supply is cut off completely.

Both the two-jaw and three-jaw "Airgrip" Universal Chucks permit using heavier cuts and coarser feeds to the very limit of the machine's power and cutting-tool endurance.

"HOLD FAST TO THE JOB TILL IT'S FINISHED"



"AIRGRIP" Revolving AIR CYLINDERS

***Double-acting* ball-bearing, high-speed revolving air cylinder with maximum life and minimum maintenance. No manual adjustments required. Wear automatically taken up by air pressure within the cylinder.**

HI-PO Supercharged HYDRAULIC PRESSURE PUMPS

3000 lb.-Pressure Pump, driven by a ½ h. p. motor! *Double-Pressure Production;* consists of a low-pressure section which *supercharges a high-pressure section.* Builds up pressure fast, with minimum pulsation.

Write us for Bulletin, and consult Anker-Holth Engineers on pneumatic or hydraulic applications.

Anker-Holth Mfg. Co.

332 S. Michigan Ave. Chicago 4, Ill.

speaker at the April 12 meeting at the Masonic Temple at Springfield, Vt. He talked on "Boring for Large and Small Production." His address covered many of the complicated problems encountered in the manufacture of gun directors and emphasized the importance of well-designed fixtures for successful boring practice.

Western Michigan: At the March 13 meeting held at Park Church, it was announced that the following officers were elected for the coming year: Chairman, E. Goodfellow; vice-chairman, T. Newby; secretary, C. Smith; assistant secretary, V. Bunker; treasurer, H. Young, and assistant treasurer, T. Vanderveen.

Wichita: John W. Rix, manufacturing engineer of Cessna Aircraft Co., was principal speaker at the March 14 meeting held at Droll's Grill.

His talk covered outstanding developments in machinery and machining processes observed at the Kearney & Trecker plant at Milwaukee and at the Willow Run Bomber plant of the Ford Motor Co.

Dr. Kurt Hoffman, chief production engineer of the Wichita Boeing Aircraft plant, was technical speaker at the April 11 meeting. He discussed methods of laying out a complete plan and forecasting the major tooling required for large scale manufacture.

Worcester: W. B. Peirce, 3rd vice-president, addressed the April 5 meeting. He presented a report on the proceedings of the Philadelphia Convention.

At the technical session, A. A. Cambria, chief engineer of Lapointe Machine Tool Co., gave an illustrated talk on "The Development of Broaching." Also on the program was a talk on "Micro Switches" by William S. Gibson and Mr. Cassidy of the Electrical Apparatus Co. of Boston.

* * * *

May Meetings

★

Chicago: May 6, Furniture Club of America. Ladies' Night.

Fairfield County: May 5. Algonquin Club. A. H. d'Arcambal, Pratt & Whitney, will talk on cutting tools.

Fort Wayne: May 10. Harold Smith and Harry Fussner, National Acme Co., will talk on "Tooling Automatic Screw Machines."

Milwaukee: May 11, Hotel Astor. Speaker will be Bradford Reed, president of Rolled Thread Die Co.

Toledo: May 10, Toledo Yacht Club. Henry D. McLarty, McLarty Business Film Co., will talk on "High-Speed Photography."

Syracuse: May 9, Syracuse Hotel. Herman Zorn, of V and O Press Co., will discuss "Press Geared for Defense."

IT'S TOO BIG A STORY

to tell on this page...

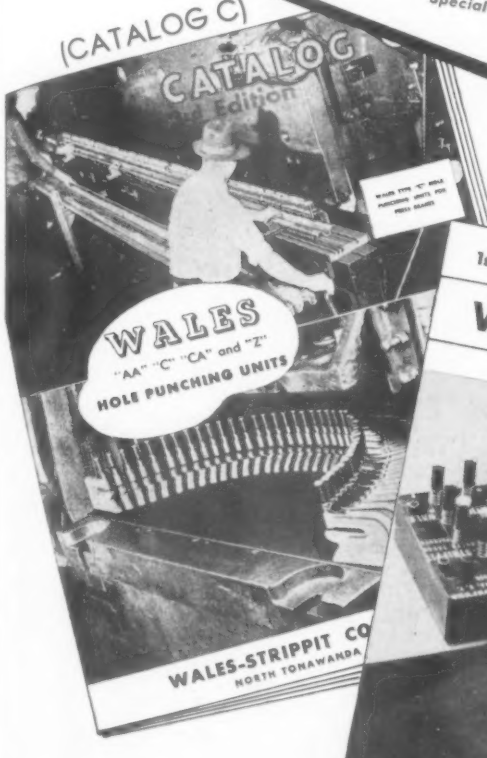
WALES HOLE PUNCHING UNITS

are cutting production costs throughout the metal fabricating industry by *reducing die costs, set-up time, and press "down time."*

The same group of units, by unique, independent, self-contained design, may be set up in unlimited patterns on press brakes and stamping presses to punch holes in channels, angles and sheets. Such wide applications and adaptations of Wales Hole Punching Units make TOO BIG A STORY TO TELL ON THIS PAGE. That is why you should write TODAY for fully-illustrated, functionally-colored catalogs that will show you how Wales Units operate more efficiently to produce greater economies both today and tomorrow.

WALES - STRIPPIT CORPORATION
353 PAYNE AVENUE
NORTH TONAWANDA, N. Y.
(Between Buffalo and Niagara Falls)
GEORGE F. WALES, President
Specialists in Punching and Notching Equipment

(CATALOG C)



(CATALOG PS)

WRITE FOR CATALOGS *Now*

A TIMELY SUGGESTION

Before spending valuable time and effort designing and building special hole punching dies to pierce angles, channels and sheets, check with Wales-Strippit engineers who may have solved your particular hole punching problems with standard Wales Hole Punching Units.

Our Safety First Belt Stick
Makes Accidents Impossible!

This belt stick attachment prevents accidents caused by operators throwing belts on and off moving pulleys with the ordinary single pin belt stick. The "Safety First" is provided with three rollers, two of them being tapered. Cannot catch. At all times the tendency is for the belt to slide on to the pulley as the stick slides away. Stop ***unnecessary*** accidents in your plant!

Write For Catalog E-42

Style S1 for belts 1" to 3" Style S2 for belts 3" to 4"
$2.00 each, $20.00 dozen

THE READY TOOL COMPANY
585 IRANISTAN AVE.
BRIDGEPORT CONN.

FOR INDUSTRIAL OIL PURIFYING
Specify HILCO
HYFLOW OIL FILTERS

HILCO Hyflow Oil Filters are used for filtering all types of industrial oils such as used for cutting and lubricating. Units are available for stationary use or portable operation for moving from one machine tool to another.

By keeping cutting and lubricating oils in good condition, oils are kept in service for an indefinite time and result in less down time, longer periods between tool grindings and better finished work. This means increased production.

★ Write today for free literature and see what Hilco operators are doing – then let us help you select a Hilco to take care of "That Particular Job."

OIL PURIFIER HEADQUARTERS

THE HILLIARD CORPORATION
107 W. FOURTH ST. ELMIRA, N. Y.

CLEARANCES are not effected by repeated sharpenings.

Each tool will take thousands of sharpenings without causing its form to change.

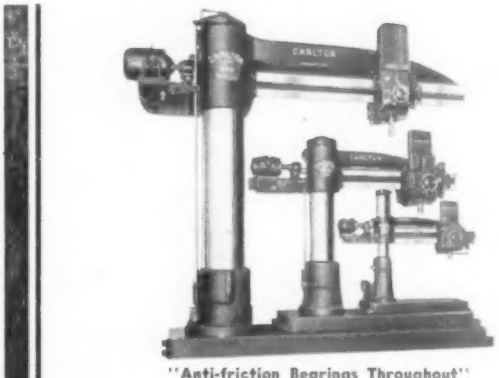
The original form remains constant due to the angle of the cutting edge and the helical backed-off form of front of tool.

Thus, sharpenings being made on the line of radius, life of tool is equal to the number of sharpenings represented in its circumference.

The same unique design that characterizes this general boring tool (Style A) also distinguishes the two other types of Bokum Tools—Style B for facing and bottoming and Style C for internal threading.

For super High Speed Tools, ask for Catalog A-1139 and for Carbide Tipped A-398.

BOKUM TOOL CO.
14775 WILDEMERE AVE. · DETROIT 21, MICH.



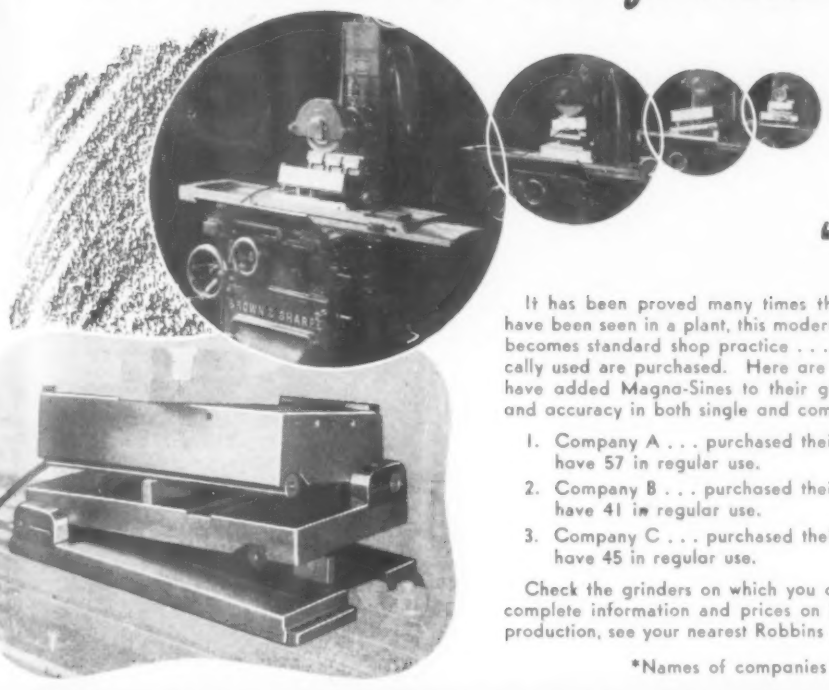
"Anti-friction Bearings Throughout"

CARLTON RADIAL DRILL FEATURES—

1—LOW HUNG DRIVE TO THE SPINDLE
2—ALL POWER DRIVEN PARTS RUNNING IN OIL
3—QUIET RUNNING AT ALL SPEEDS
4—CONCENTRATED AND CONVENIENT CONTROLS
5—CONSTRUCTED ON UNIT PRINCIPLE

THE CARLTON
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U.S.A.

MAGNA-SINE *Usefulness* IS SHOWN IN THE RECORDS OF *Hundreds* OF "REPEAT" ORDERS



It has been proved many times that, once the advantages of the Magna-Sine have been seen in a plant, this modern method of securing angular grinding set-ups becomes standard shop practice . . . and as many Magna-Sines as can be practically used are purchased. Here are typical examples of how leading companies* have added Magna-Sines to their grinding equipment to get greatest efficiency and accuracy in both single and compound angle set-ups:

1. Company A . . . purchased their first Magna-Sine January 16, 1937 . . . now have 57 in regular use.
2. Company B . . . purchased their first Magna-Sine October 5, 1936 . . . now have 41 in regular use.
3. Company C . . . purchased their first Magna-Sine January 31, 1941 . . . now have 45 in regular use.

Check the grinders on which you can use additional Magna-Sines. If you want complete information and prices on the size and type of units best suited to your production, see your nearest Robbins representative, or write us direct.

*Names of companies will be supplied upon request.

ROBBINS ENGINEERING COMPANY
318 MIDLAND AVENUE • DETROIT 3, MICHIGAN

NEED SPROCKETS fast?

ORDER FROM CULLMAN

There is no time to experiment when you need sprockets for essential war work.

Cullman Wheel Company carries more than 50,000 sprockets in stock---and can make them to your specifications quickly and economically. When you order Cullman Sprockets, you get the benefit of specialized equipment and experience---with consequent savings.

Write for booklet giving necessary information for sprocket users.

CULLMAN WHEEL CO.
1352-R ALTGELD ST., CHICAGO 14, ILLINOIS

GRAND *Speed* CLAMPS

The Most Complete and Up-to-the-Minute Line of Modern Time-Saving Clamps

Quikcet

Screws, Swivels and Handles COPPER PLATED against Welding Spatter

QUIKCET for fast (4-second) Clamping — Instant ratchet set and release, fulcrum screw tightening, 1-hand operation and a non-creeping grip even on irregular surfaces. Setting the pace in war production.

Dual Grip

DUAL GRIP — Double action malleable clamps. Side tightening for close working conditions. No twisting or creeping.

Ground Clamp

WELDERS' GROUND CLAMP. Completely copper plated, with connection for ground wire.

Alloy-Steel

ALLOY - STEEL Medium and heavy service "C" Clamps of **even greater than forged clamp capacity.** Also a complete line of Malleable "C" Clamps.

HEAVY DUTY SPEED CLAMPS. 2-handed, lever locking and instant release. Also Giant 10½" opening size.

Heavy Duty Speed

QUICK LOCKCET — For light fast work. Locking lever gib seat and instant trigger release.

Quick Lockcet

Our 32-page catalog illustrates and describes these production clamps in detail. A copy is yours for the asking. Write today.

GRAND SPECIALTIES CO.
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THE PASSING PARADE

T.M. REG. BY THE BRAMSON PUBLISHING COMPANY

THE EVER-CHANGING SCENE IN MASS MANUFACTURING

Ralph S. Howe has been elected vice-president and manager of new Britain-Gridley Machine Division of The New Britain Machine Co. An employee of the company since 1920, he has held the offices of treasurer and factory manager.

Julian C. Pease has been elected assistant secretary and factory manager of the Machine Tool Division, and **William J. Lofgren** has been named treasurer to succeed Mr. Howe.

R. S. Howe

J. T. Meade

Joseph T. Meade, formerly personnel and industrial relations manager for Sheffield Farms Co., Inc., has been appointed personnel director for Mack Trucks, Inc. His office will be in the Empire State Building in New York.

He is a member of the Public Relations Committee of the National Association of Manufacturers, is at present on the Appeal Panel of the War Manpower Commission for the New York area.

William W. Sproul, Jr., has been appointed manager of the application department of the Sharon Works of the Westinghouse Electric and Manufacturing Co.

A graduate of Virginia Polytechnic Institute with a B. S. degree in electrical engineering, he has served the company in many capacities, his most recent, prior to his new appointment, being manager of the transformer equipment section.

James M. White has been elected a vice-president of the Allis-Chalmers Manufacturing Co.

After graduation from the Alabama Polytechnical Institute, he joined Allis-Chalmers in 1929 where he completed the company's training course for graduate engineers. He was successively trouble shooter on shop and field jobs, manager of the company's LaPorte Works, assistant general works manager, and works manager.

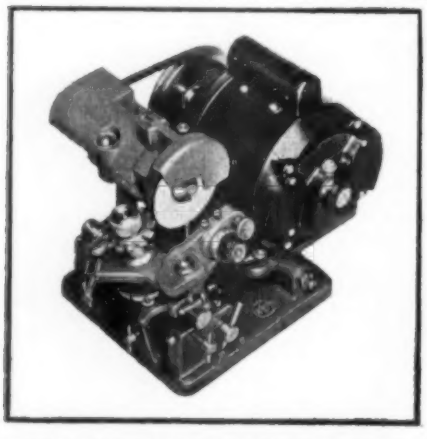
William C. Johnson, former general sales manager, and **William A. Roberts,** formerly manager of the tractor division, also were elected vice-presidents at the same time.

J. M. White

W. H. Gourlie

William H. Gourlie, formerly an executive of the Pratt and Whitney Division of Niles-Bement-Pond for 20 years, is manager of R. T. Palmer Company, newly appointed New England representative for the gage and precision instrument division of Sheffield Corporation.

(Continued on page 218)



ANNOUNCING THE NEW

Waltham

CUTTER SHARPENER

Available with index plates or pawl locating attachment

The new Waltham Cutter Sharpener is designed to keep cutters in production—to make sharpening a fast, accurate operation—to do this easily and economically even with inexperienced labor.

This machine can be used for sharpening cutters such as those used for gear cutting and thread milling, circular form tools, straight fluted hobs, and multiple cutters. These may be sharpened radially or with any desired rake angle. Maximum capacity is 2" diameter and ⅜" thick.

The standard machine is designed to use an index plate for each cutter size. A pawl locating attachment can be furnished for locating on the top relieved portion, or the back of the teeth if desired.

The Waltham Cutter Sharpener is complete—put it on any handy bench—plug into a 110-volt line—it's ready to go, and ready to sharpen cutters for maximum efficiency. Complete information will be found in a new, illustrated catalog—send coupon for your free copy today!

EDWARD BLAKE CO.

634 COMMONWEALTH AVENUE
NEWTON CENTRE 59, MASS.

Please send me new folder giving full details on the Waltham Cutter Sharpener.

NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... STATE .....

TE

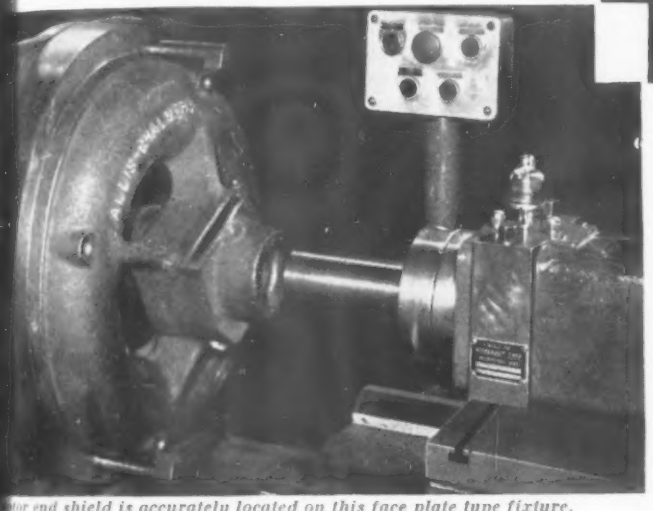
BLAKE-TAP GRINDERS—L & D HIGH SPEED DRILL PRESSES—WALTHAM CUTTER SHARPENERS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS

Motor End Shield Bearing Seats Precision Bored on

STOKERUNIT SIMPLEX *Precision* BORING MACHINE

The two bearing seats in this electric motor end shield are precision bored in one operation.

No. 2U Stokerunit Simplex Unit-Type Precision Boring Machines are adaptable to a wide range of work.



...or end shield is accurately located on this face plate type fixture.

Finish Boring Time 2 Minutes for Both Seats . . . Total Boring Length—2¾″

The two bearing seats in the end shield of this electric motor are precision bored on a No. 2U Stokerunit Simplex Single-Spindle Precision Boring Machine. Both are identical in diameter—3.6875″. Length of bore on first seat is 1½″, on the second 1¼″. As they are spaced 4⅛″ apart, a total spindle travel of more than 6⅞″ is necessary to complete the boring operation.

The total boring time of only 2 minutes for both bearing seats is made possible by rapid traverse of the Stokerunit Simplex spindle unit, which automatically provides quick approach to cutting position at each seat and quick return at end of machining cycle.

Additional Boring Data: Spindle speed 400 r.p.m.; feed 1⅜″ per min. Tolerance on finish bore is −.001″; high finish is produced. Material is cast iron. Tungsten carbide cutters are used.

The face plate type locating fixture has multiple locating rabbets for holding various sizes of end shields. This fixture is also equipped with an adapter for holding various sizes of ball bearing cages up to 6″ in diameter while boring the ball bearing seats.

Profit with Stokerunit Versatility . . .

Over 25 versatile models of Stokerunit Simplex Precision Boring Machines are available to solve *your* precision boring problems. They cover practically the entire range of precision boring applications and can be furnished in mechanical and hydraulic feeds, with single or multiple spindles, for either short-run or production work.

For specific recommendations, send blueprints of parts with production requirements. No obligation.

Write Today for these two booklets covering details of our entire line of Simplex Precision Boring Machines.

STOKERUNIT CORPORATION

DESIGNERS AND BUILDERS OF PRECISION BORING MACHINES AND MILLING MACHINES

4528 WEST MITCHELL STREET • MILWAUKEE 14, WISCONSIN

Mr. Gourlie has studied gaging problems at first hand and has worked with concerns engaged in precision work for many years. His activities include work with such organizations as the American Gage Design Committee, National Screw Thread Commission, American Standards Association, American Society of Mechanical Engineers, ASA War Committees and the Ordnance Department.

Thomas H. Wagner has been appointed assistant to the president of the Eureka Vacuum Cleaner Co. His duties will cover work on such assignments as postwar planning, war contract terminations, and special activities on current war work.

K. T. Vangsnes has been named by the Dow Chemical Company to head the magnesium division of its Los Angeles office. For the past five years Mr. Vangsnes has been vice-president of Magnesium Products, Inc.

Harold E. Strang, engineer of the General Electric Co. Philadelphia Works for the past three years has been named to the staff of **H. A. Winne**, vice-president in charge of design engineering, apparatus department. He will be located in Schenectady.

A graduate of Rensselaer Polytechnic Institute with a B. S. degree in electrical engineering, Mr. Strang joined General Electric as a test engineer at the Schenectady Works in 1922. He has held posts as a member of the switchboard engineering department, application engineer, and managing engineer of the Large Power Circuit Breaker Division.

H. E. Strang

F. Markwick

Fred H. Markwick has been appointed general plant manager of the manufacturing division of Sheffield Corporation. His duties will include supervision of all factory production.

An employee of the organization since 1917, Mr. Markwick has had many years of experience in the precision production field. For the past several years he has been plant manager of the gage-manufacturing division.

D. J. Stewart has been appointed vice-president and general manager of Barber-Colman Company to succeed **Earle D. Parker**. Mr. Stewart previously was assistant general manager.

H. F. Collins, formerly assistant general superintendent of the company has been appointed works manager.

E. F. Russell has been named superintendent of the Tocco Process Assembly Division of The Ohio Crankshaft Company, according to **William C. Dunn**, president. He succeeds **A. G. Byerley** who has been appointed special assistant to the president.

Robert S. Archer has been appointed metallurgical assistant to C. M. Loeb, Jr., vice-president of Climax Molybdenum Co. He will work in New York.

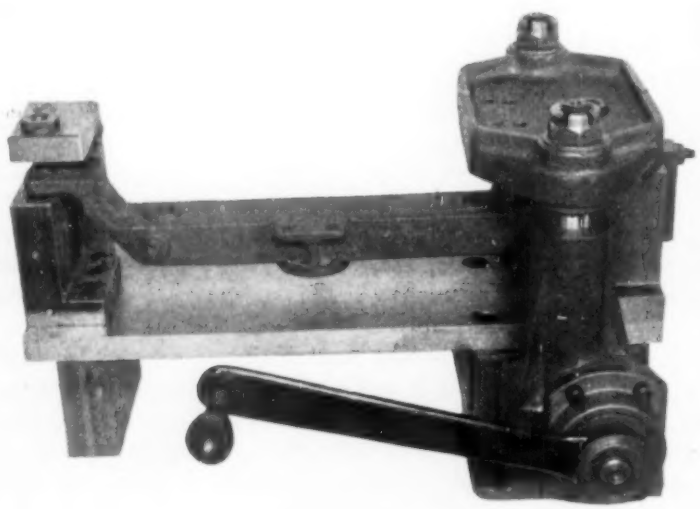
Mr. Archer previously had been connected with Republic Steel Corp. as metallurgical engineer for the Chicago district since 1934.

Frederic V. Hetzel, consulting engineer and writer on technical subjects, has been appointed a member of the American Standards Association's Committee on Transmission Chains and Sprockets.

The Committee deals with formulation of standards for transmission roller chains and sprocket teeth.

Ellis L. Spray has been named by Westinghouse Electric and Manufacturing Co. as assistant to the president in charge of the Headquarters Manufacturing Division in Pittsburgh. His duties will include such problems as coordination of the company's manufacturing divisions, quality control,

(Continued on page 224)



STANDARD DRILL JIGS AND FIXTURE LOCKS

A Long Manifold is Clamped in a Small Fixture for Drilling End Holes with Accurate Spacing. Standard Fixtures Will Offer Economical Tooling for YOUR Production Parts. Our Engineering Dept. Will Be Glad to Make Suggestions. Send Us Your Part Prints.

SEND FOR CATALOG 941

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley **Detroit, Michigan**

Represented by

Cleveland—J. W. Mull, Jr.
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Canada—Hi-Speed Tools, Ltd., Galt, Ont.
St. Louis—Mill Supply & Mach. Co.
Beverly Hills, Cal.—Production Tool Engineering
Houston—Engineering Sales Co.

Oneida, N. Y.—W. F. Himmelsbach
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

Leakage

Model 11020-A

GUSHER COOLANT PUMPS

Packing nut, foot and relief valves are eliminated—yet, there is no friction or binding, ***and no leakage.*** Large ball bearings and sturdy one-piece suspended shaft insure rigidity and longer life. Delivers coolant from a dribble to maximum capacity. There is a model and type for your needs. Write for complete new catalog.

Model 11020-A—Internal discharge type. Outside piping eliminated. From 1/10 to ¾ h.p.

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1815 READING ROAD CINCINNATI 2, OHIO
The "Gusher"—A Modern Pump for Modern Machine Tools.

IM IM

REID Automatic Feed Surface Grinder No. 2A

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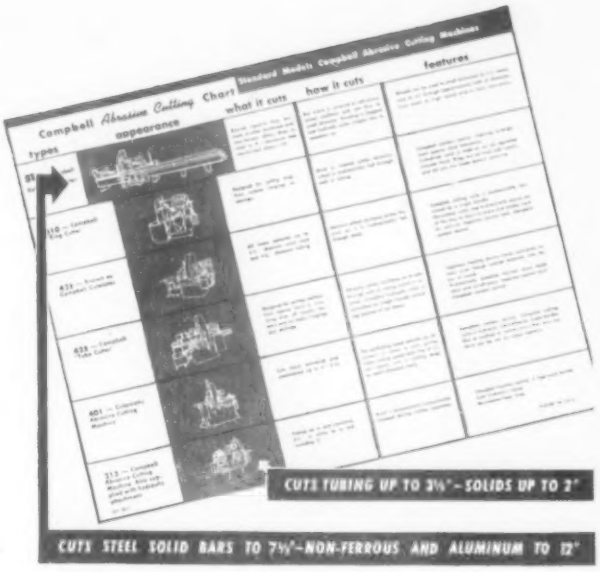

Campbell Abrasive Cutting Machines Chart
Standard Models Campbell Abrasive Cutting Machines
types
appearance
what it cuts
how it cuts
features
CUTS TUBING UP TO 3½"—SOLIDS UP TO 2"
CUTS STEEL SOLID BARS TO 7½"—NON-FERROUS AND ALUMINUM TO 12"

Ask a Campbell Engineer to suggest cutting procedure and figure costs for your cutting . . .

CAMPBELL manufactures a complete range—in fact, the *only* complete range—of machines for abrasive cutting. 8 types, 19 models and countless variations developed to meet the jobs of cutting steels, annealed and unannealed; non-ferrous metals, plastics, glass and ceramics—solid bar, tubular and flat stock.

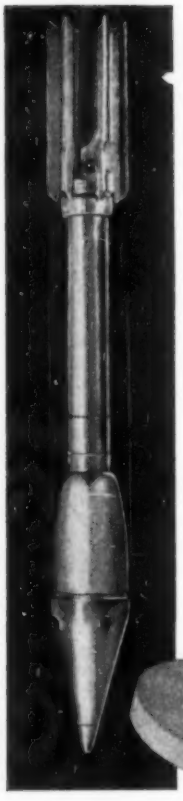
One corporation alone has found CAMPBELLS so efficient that they now use 120 CAMPBELL CUTTING MACHINES in their several plants.

Call on this wide experience of CAMPBELLS and ask them what cutting procedure they would recommend for your plant—what the cost per piece would be. It doesn't put you under any obligation to do this but be sure to state materials you cut, shapes, lengths before cutting, lengths of cut-off pieces and production desired per hour.

Campbell
ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT
ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ACCO
AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT



BAZOOKAS and BOMBERS

Minimum wind-resistance is a "must" for bazooka shells and bomber wings—Brightboy *rubber cushioned* abrasives get the call for the close-tolerance de-burring, finishing and polishing of these vital implements of war. Brightboy's *combination* of abrasive, impregnated throughout a resilient rubber binder, does the job!

Ask our Service Department or field representatives how to save time—improve quality—in your abrasive finishing. Ask your dealer for prices and Applications Data.

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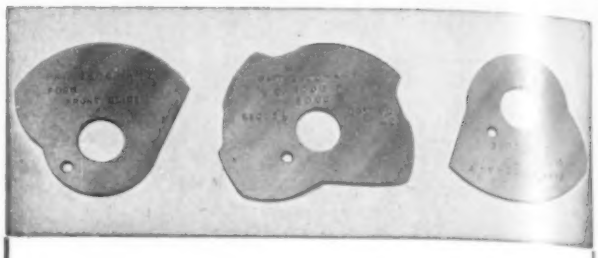
Weldon Roberts Rubber Co. Newark 7, N. J.

WELDON ROBERTS

Brightboy



SCREW MACHINE CAMS for B & S MACHINES

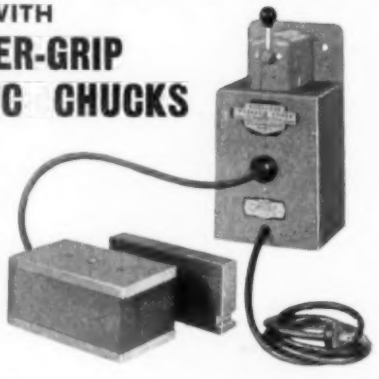
Cams cut to your layout shipped within 2 to 3 days.

Set of 3 No. 00 Cams including blanks, cutting, heat treating — $6.20 complete. Other sizes in proportion.

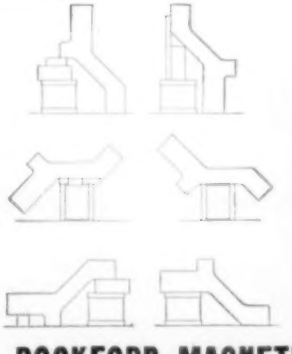
GEORGE L. DETTERBECK CO.
1871 CLYBOURN AVENUE
CHICAGO, ILL.

MAGNETIC SHORTCUTS WITH POWER-GRIP MAGNETIC CHUCKS

For Production and tool room, planer, miller, grinder, shaper, and similar applications. Sealed against coolants. No heat, no burnouts.



Complete Unit



Irregular piece held for grinding faces as illustrated. Ordinary steel spacers and no clamping. Our special control plugs into 110 volt A-C. No generator or tube. Send for literature or demonstration.

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MANPOWER—

You can conserve manpower by using tool steel that gives trouble-free, long run and high speed production.

It pays to use Good Tool Steel.

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ARTHUR T. CLARAGE, PRESIDENT
GENERAL OFFICE AND WORKS
520 EAST 14TH. STREET • CHICAGO HEIGHTS, ILL.

from simplest

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GAUGES — TOOLS — FIXTURES
JIGS — SPECIAL MACHINES
DESIGNING & ENGINEERING
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BARTH STAMPING & MACHINE WORKS

Die & Tool Makers

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PERMANENT MARKING

. . . with Matthews 204
GENERAL PURPOSE MARKING MACHINE

Any desired lettering or design clearly and permanently marked on your products with this machine. Marks parts up to 6" in diameter or thickness. Furnished in hand operated, pneumatic and motorized models.

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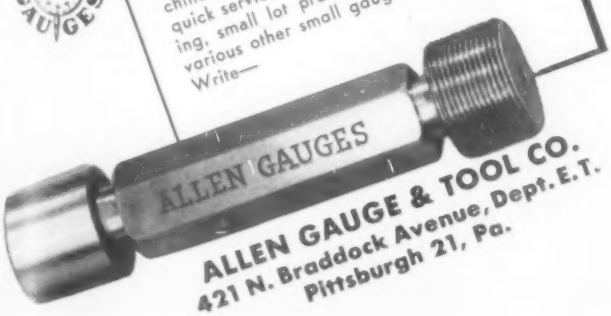
With ALLEN GAUGES of all types—profile — length — flat — flush pin — snap — limit.

Also prompt delivery on special gauges for Ordnance Departments, plain plug & ring gauges, special jigs, fixtures and machinery. Send us prints for quotations and quick service on production thread grinding, small lot production machining and various other small gauges and products. Write—



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NIELSEN
LIVE
CENTERS

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Load capacity
200 to 40,000 lbs.
at 100 rpm

Have adjustment
to take up wear
and
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Standard Morse
Taper No. 2 to 6
in stock

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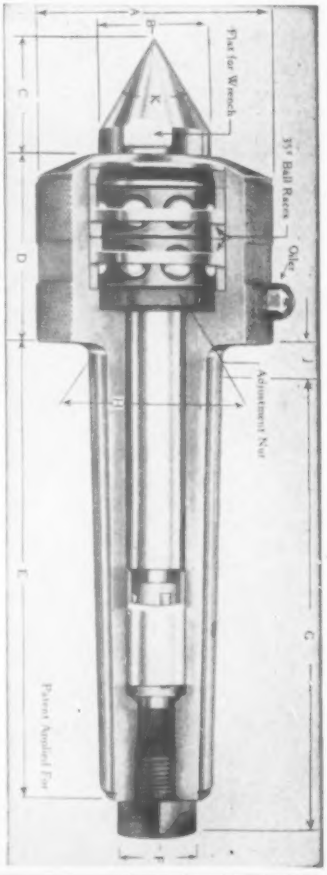

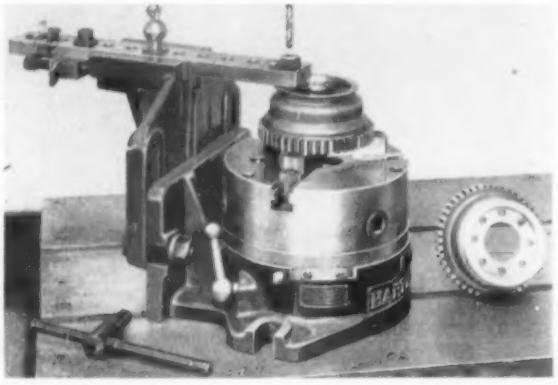

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The Hartford Super-Spacer shown above, fitted with drilling attachment, is drilling spaced holes in a circle. It provides ample adjustment for all jobs within its range and is ideal for drilling odd lots of flanges or other parts where spaced holes on a circle are required. It is equally valuable on large lot production, saving the cost of many special jigs.

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Determine Surface Flatness to Millionths of an inch

with

ACME
OPTICAL FLATS

★ Deviations from absolute flatness can be quickly and easily determined in millionths with the aid of Acme Optical Flats and Monochromatic Lamp.

Illustration shows interference bands reflected from a truly flat surface as they are seen through an Acme Optical Flat. The straightness of the bands determines the flatness of the surface.

Our new booklet, "Shop Measurements to one millionth of an inch", describes in simple detail how light waves are used to measure in micro-inches. Write for a copy today . . . It's yours for the asking.

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Makers of Standarized Jig and Fixture Bushings
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The best "soft" hammers and mallets are rawhide —tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.

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C/R

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DIAMONDS for Victory

New!
HANDL-NIB
(Trademark Reg.)
RE-SET-ABLE
DOUBLE DUTY
DIAMOND DRESSER

Ejector Rod

2 TOOLS For the PRICE of ONE

Heavy Duty Tool with 7/16" shank "BIG-HED-NIB" Interchangeable For MACHINE or HAND TOOL DRESSING

This new DTCo "HANDL-NIB" easily dresses wheel faces up to 2" wide with a single rotation of the wrist. Patents pending.

—DETACHMENT INSTRUCTIONS—

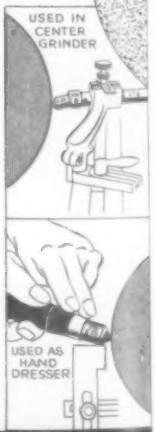
For separate use of "BIG-HED-NIB" in adaptor on machine simply tap on ejector rod to release nib from "HAND-NIB" holder.

Can be returned to handle in a jiffy for hand dressing.

Supplied Free when requested with orders for RE-SET-ABLE LOC-KEY-SET BIG-HED-NIBS of 2 carats or over.

Three grades of diamonds. Common quality $12 per carat. Medium quality $24 per carat. Select quality $48 per carat.

"For a New Front" buy RE-SET-ABLE



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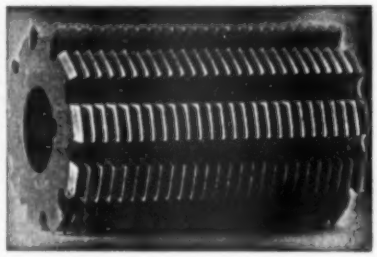

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Frank B. Wilkinson, founder of Logansport Machine Co., Inc., died at Logansport, Ind., March 23 at the age of 87.

Mr. Wilkinson was instrumental in founding several other manufacturing companies in addition to the Logansport Machine Co., Inc., although he was most prominently identified with the latter firm. He had not been active in the business for several years.

F. B. Wilkinson

F. F. McIntosh

Frederick F. McIntosh, director of metallurgy for Crucible Steel Company of America, died February 23 at Sewickley, Pa. He was 62 years old.

Holder of the first degree in metallurgy ever granted by Harvard University, Mr. McIntosh was associated during his life time with Bethlehem Steel Co., Carnegie Institute of Technology, and the Ordnance Section of the United States Army. He had been director of metallurgy for Crucible Steel since January of 1939.

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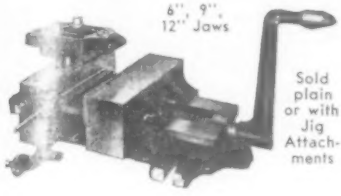

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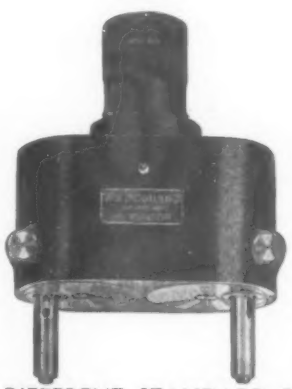

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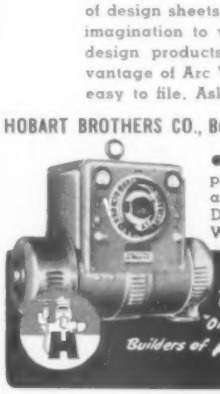

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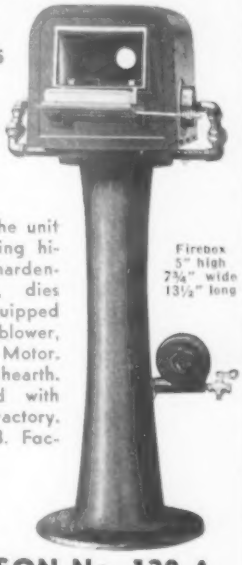

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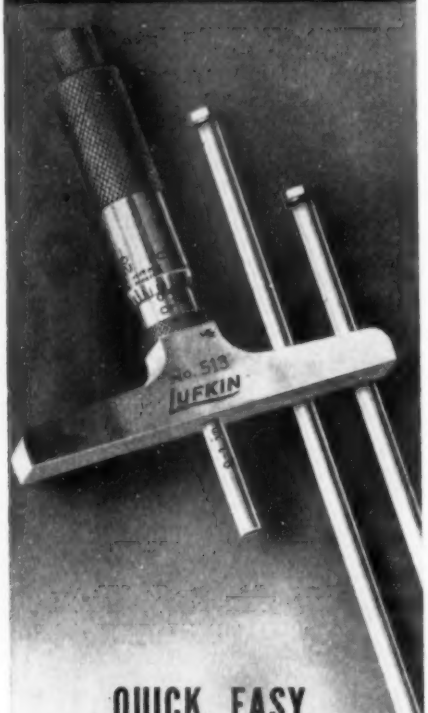

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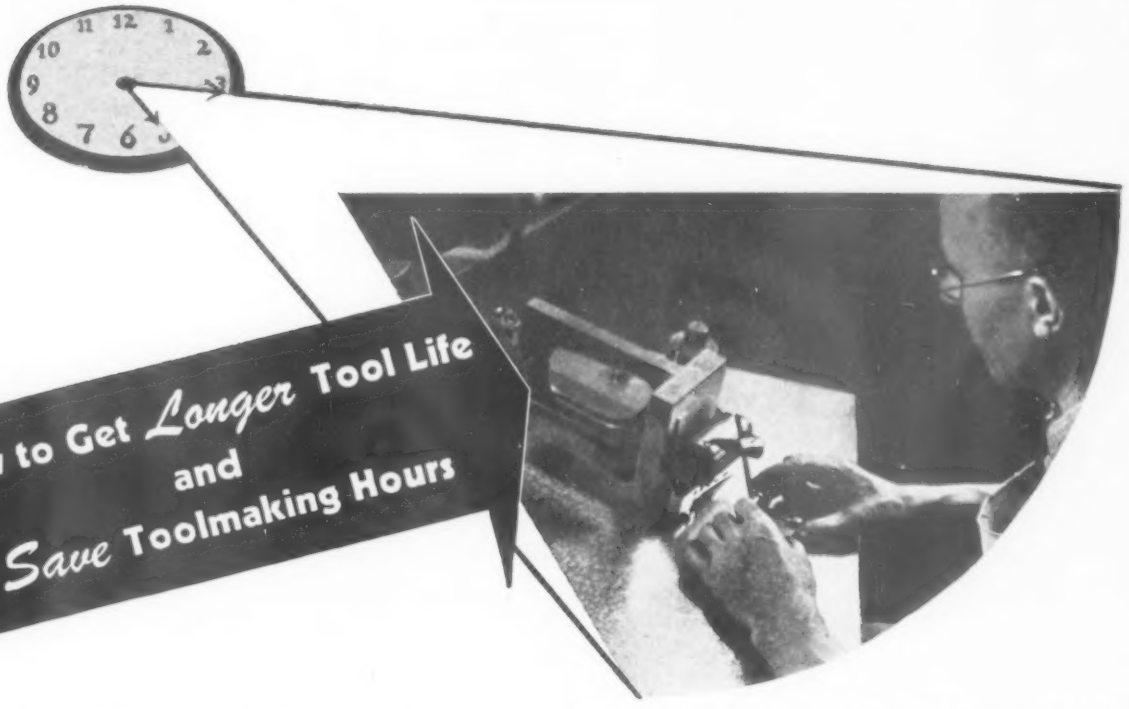

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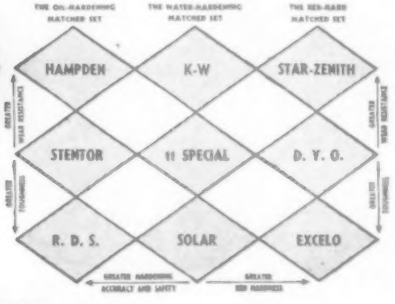
How the Carpenter Matched Set Diagram Goes to Work on Tool Steel Problems . . .



These nine steels will solve practically any problem in your tool room. They are really *Matched* Tool Steels, as one picks up its job where the other "leaves off".

The key steel is the one in the center, *No. 11 Special*, a straight carbon, tough timbre, water-hardening tool steel. When you have a tool to make, you first find out if it can be made from *No. 11 Special*. If the answer is "Yes", you go no further. But when the answer is "No", you use the diagram to point the way to the best tool steel for the job. For greater *wear resistance*, you go north. For greater *hardening accuracy* and *safety*, you move west, etc.

To learn more about the Matched Set Method, ask for a copy of the 167-page *Matched Tool Steel Manual*. It contains an 80-page Tool Index and Steel Selector that will be of special value to men responsible for tooling and tool production. For your copy, drop us a note on your company letterhead. Free to tool steel users in the U. S. A.

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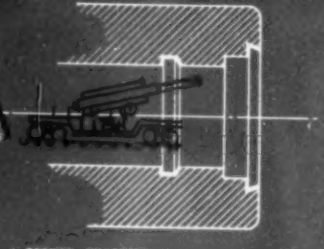
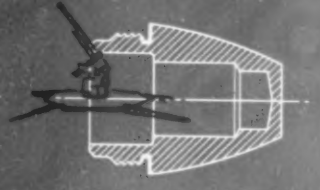
WHERE grooves or recesses are to be cut, whether internal or external, SCULLY-JONES AUTOMATIC TOOLS will speed up and increase your production. Tools of this type may readily be used in drill presses, thus freeing more urgently needed machines. * Fine adjustments are provided for controlling diameter and the location of grooves. * On some styles, the use of various interchangeable cutters in one body, make it adaptable to different recessing operations.

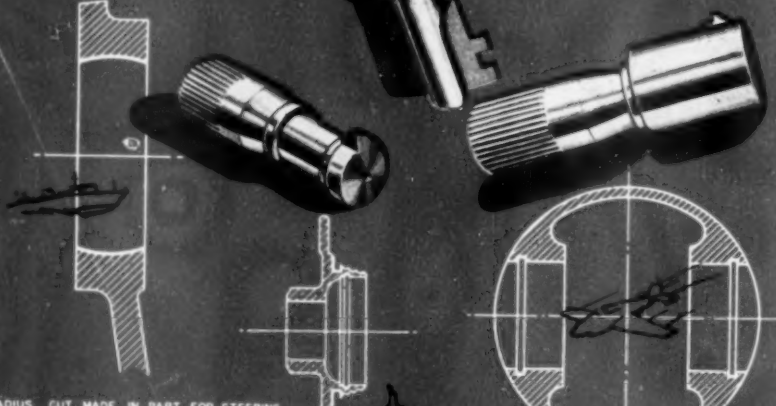
FACING AN INTERNAL BOSS ON "JEEP" MOTOR CASTINGS WHERE OBSTRUCTION USUALLY CAUSES DIFFICULTY.



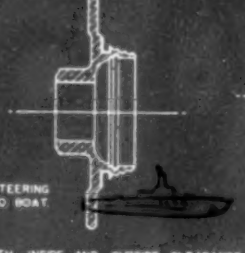
FORMED RECESSES MADE IN ONE OPERATION ON DETONATOR BUSHINGS OF LARGE CALIBRE MOTORIZED ARTILLERY RIFLES.



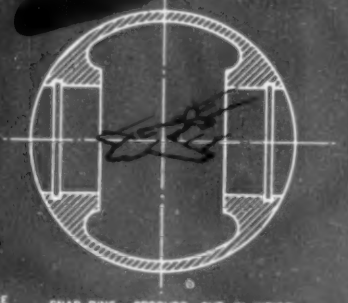
GROOVE FOR THREAD CLEARANCE CUT ON ANTI-AIRCRAFT PROJECTILE WITH AUTOMATIC "NECKING" TOOL.



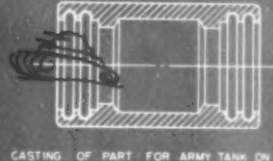
RADIUS CUT MADE IN PART FOR STEERING GEAR MECHANISM OF POWER TORPEDO BOAT.



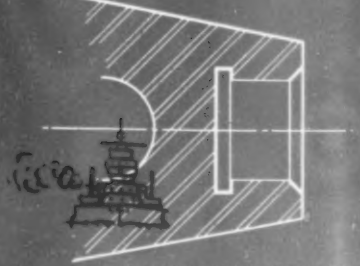
BOTH INSIDE AND OUTSIDE CLEARANCE GROOVES CUT IN ONE OPERATION ON OIL TANK CAPS FOR SUBMARINES.



SNAP-RING GROOVES CUT IN WRIST PIN HOLE OF AIRPLANE PISTONS.



CASTING OF PART FOR ARMY TANK ON WHICH TWO RECESSES ARE MADE AT ONE TIME.



HEAVY UNDERCUT AND CHAMFER MADE IN ONE OPERATION ON LARGE NAVAL GUN PROJECTILE.

SCULLY-JONES AND COMPANY

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